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The Welding Engineer

Vol. III. Chicago 608 S. Dearborn St. MARCH, 1918 $2.00 per year in U. S. $2.50 per year abroad No. 3

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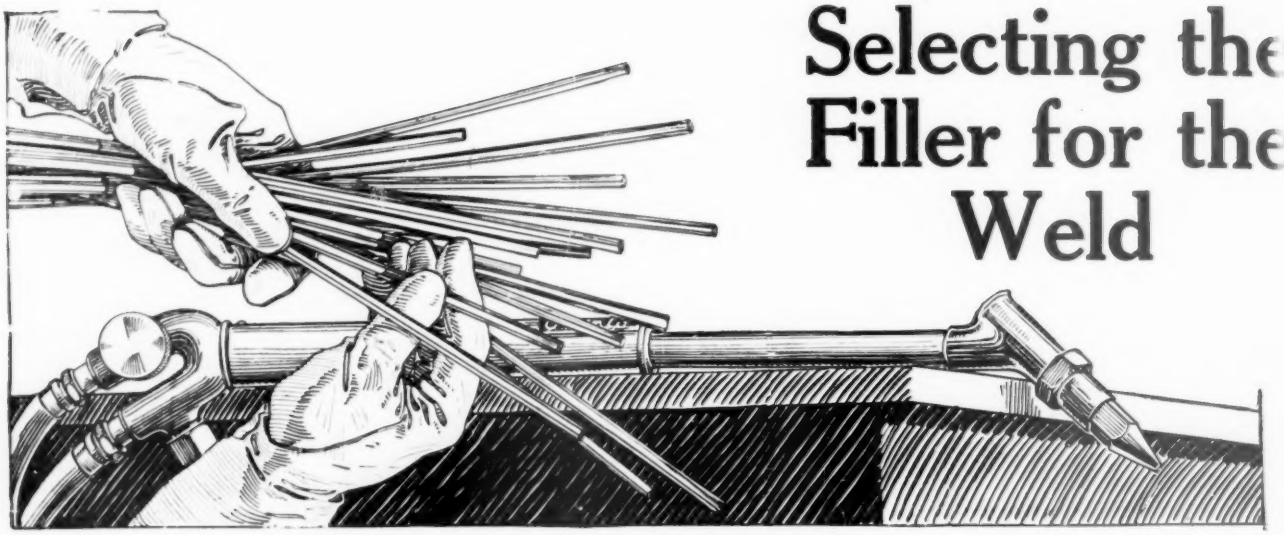

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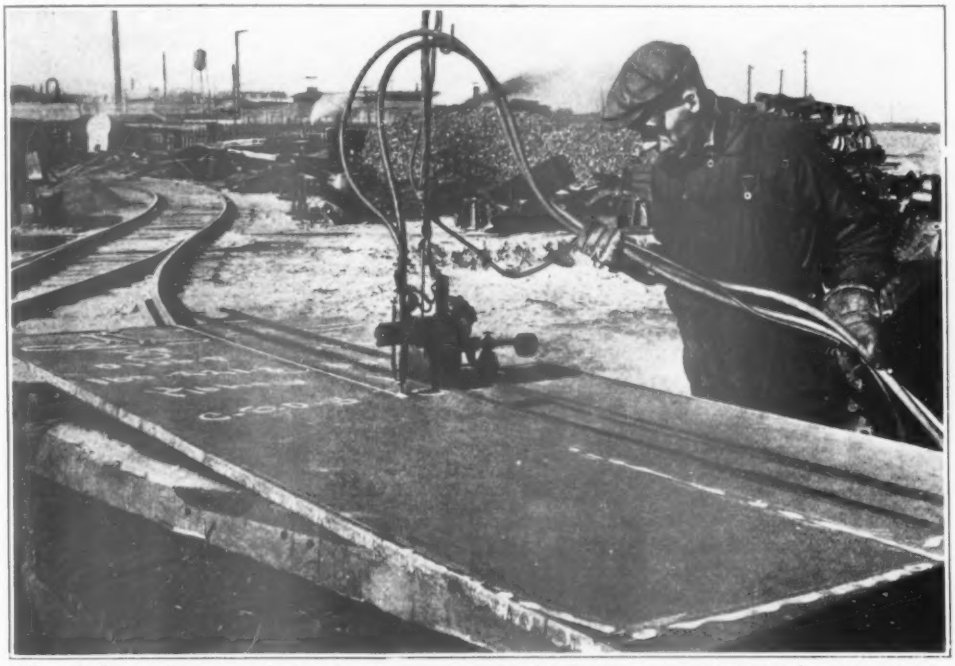

The Radiagraph, an exclusive Davis-Bournonville development for mechanical cutting with the oxy-acetylene or oxy-hydrogen flame, employed for cutting steel plate in the New York Shipbuilding Yard.—Photo by New York Shipbuilding Corpn.

Exclusive developments in mechanical cutting and welding with Oxy-Acetylene and Oxy-Hydrogen have been of invaluable assistance to metal workers, coupled with highest efficiency in results and lowest operating cost. The Radiagraph cuts from ½-in. to 20-in. steel plate, in straight lines or circles. The Oxygraph cuts in any direction, according to pattern or drawing, along straight lines, curves or sharp angles. Speed from 3 to 18 inches per minute according to thickness.

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Burdett Oxygen Co.
Oxweld Acetylene Co.
Page Woven Wire Fence Co.
Steel Sales Corp.

ALPHABETICAL INDEX TO ADVERTISERS

A
William C. Adams 39
Air Reduction Sales Co. 13
Alger Supply Company 42
American Welding Co. 42
Anti-Borax Compound Co. 38
Atlas Foundry Co. 40

B
The Bastian-Blessing Co. 8
Bermo Supply Co. 42
Bierman-Everett Fdy. Co. 41
Buffalo Dental Mfg. Co. 9
Burdett Oxygen Co. 33

C
Canada Carbide Sales Co. 35
Carbo-Hydrogen Co. 13
Chicago Eye Shield Co. 41
Commercial Acetylene Welding Co. Back cover
Cortland Welding Compound Co. 37

D
Davis-Bournonville Co. 5

E
The Evleth-Lindsay Co. 42

F
F. D. Farnam & Co. 9

G
General Electric Co. 12

H
The Harris Calorific Co. 13
Henderson-Willis Welding & Cutting Co. 41
Hauck Mfg. Co. 3

I
Ideal Face Shield Co. 42
Imperial Brass Mfg. Co. 13
International Oxygen Co. 39

K
K-G Welding & Cutting Co. 3

L
The Lincoln Electric Co. .....
Linde Air Products Co. 14

M
Messer Mfg. Co. 41
Metal & Thermit Corp. 31
The Alexander Milburn Co. 3
Morey Flux & Chemical Co. 42
Modern Engineering Co. 38

N
National Carbon Co. 42

O
Oxweld Acetylene Co. .....
Oxweld Railroad Service Co. 1

P
C. A. Parliament .....
Page Steel & Wire Fence Co. .....
Prest-O-Lite Co., Inc. .....

S
Superior Oxy-Acetylene Machine Co. .....
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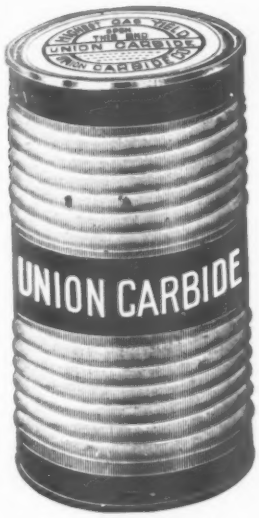
Steel Sales Corporation .....

T
The Thermalene Co. .....
Torchweld Equipment Co. .....Front

U
Union Carbide Sales Co. .....
United States Welding Co. .....
Universal Oxygen Co. .....
U. S. Gauge Co. .....

V

W
P. F. Willis. 42



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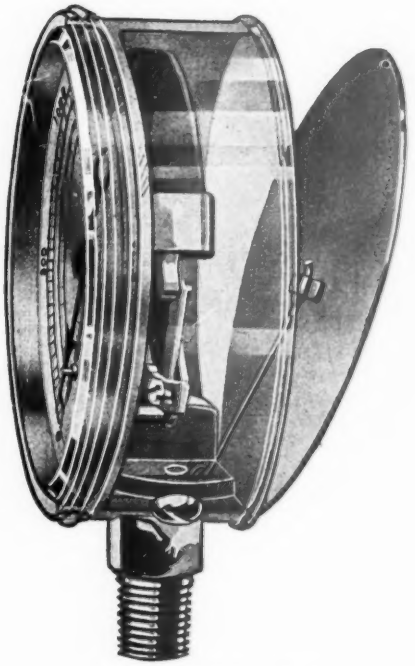

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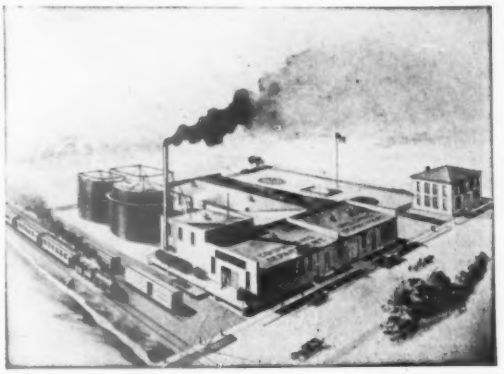

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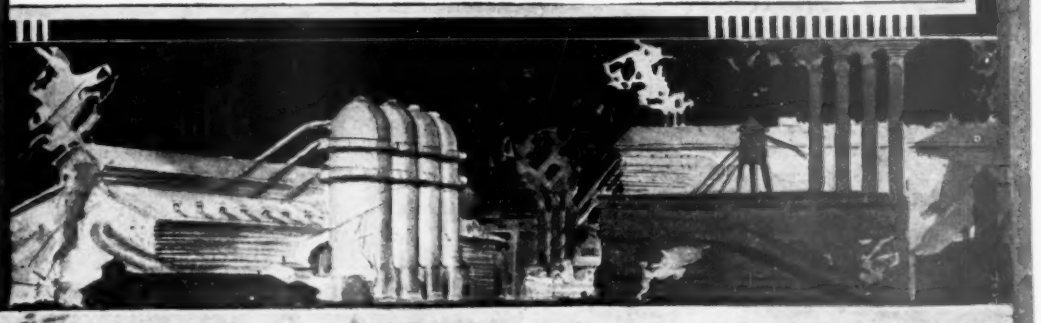


WELDING LOCOMOTIVE CYLINDERS

The Quick Repair of Locomotives is a Grave Problem —Traffic Must be Moved—Welding is Doing Its Part

By B. Kopperschmidt

A man is most efficient when his work gives him the greatest satisfaction and when he is doing conscientiously the thing his Creator intended he should do. Every welder, from the student to the master, should get two things out of his work: First, joy in doing it (or at least satisfaction); second, a decent living. And the welder who has found the work his soul is blindly craving, the work for which he has inborn talents, gets these. The welder whose whole being revolts at his task becomes an inefficient worker, and a meager earner.

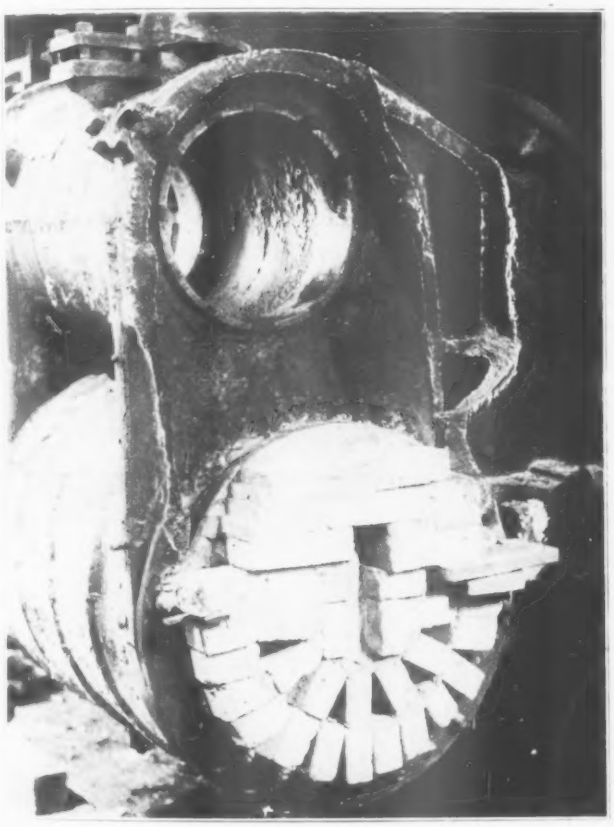


Fig. 1. Locomotive Cylinder Before Welding.

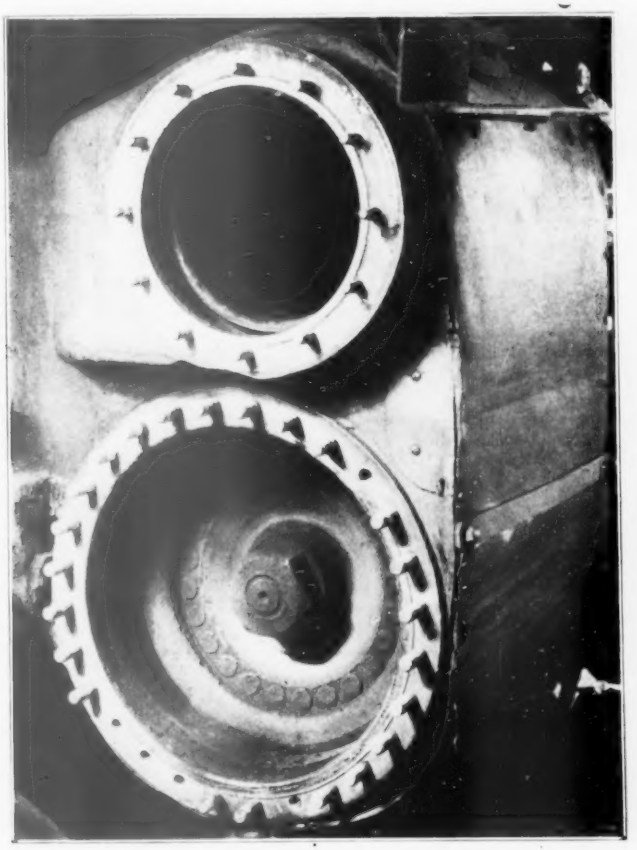


Fig. 2. Locomotive Cylinder—Left Side.

The writer blundered a great deal in his youth before he settled into his present profession. His parents thought of keeping him entirely out of the shops, but when he got through with high school, he knew that he did not care to go to college, yet he had not the faintest idea what he wanted to do for a life work. The whole world looked good to him, but he could not discover any particular bent. His father started him as a time keeper. He did not like it, so he went cheerfully from one type of clerical work to another for three years, always working hard and faithfully, but without satisfaction either to himself or to his employers. All this time his father (who was employed in the same institution as a master coppersmith) was taking account of his talents. Certain characteristics began to stand out, and one day his father put the question bluntly to him, "Ben, how would you like to be a coppersmith?" His answer might possibly be called a grateful yell for yes. During the course of the next few years after he mastered his profession he did not care to be under accurate directions or to be eliminated from personal initiative, and craving for more responsibility he obtained the foremanship at another shop and retained such positions to the present day. However, a few years later he found, with great regret, that his handicraft offered him no more complicated problems to solve, no more tasks of big dimensions to accomplish. He was looking for some new handicraft that could be added to his own profession to make it more active and more responsible and that is how he came to embrace the oxy-acety-

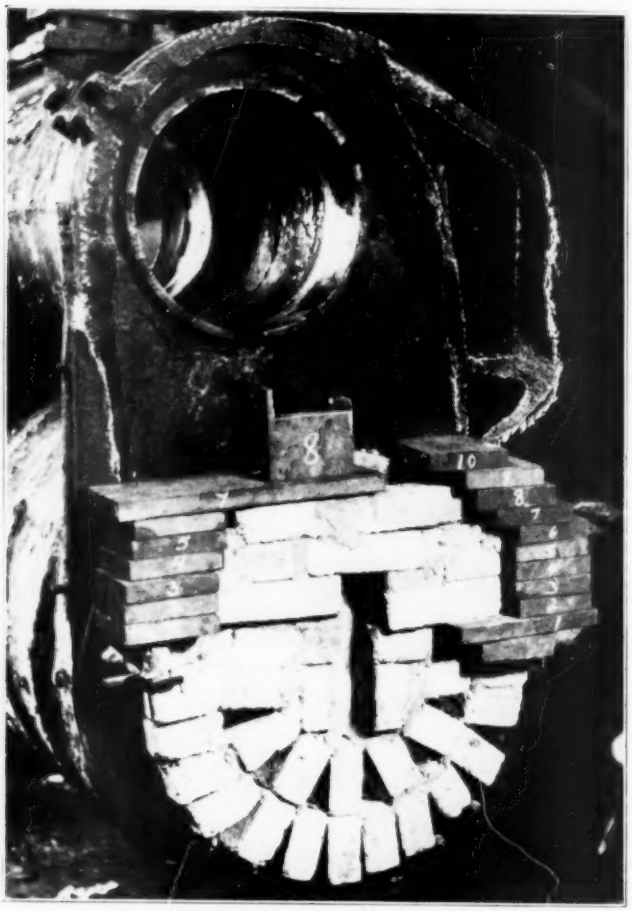


Fig. 3. Preparation for First Weld.

Fig. 8. Third Operation Completed.

Fig. 4. Fire Clay Core to Form Port Holes.

Fig. 6. Second Operation Completed.

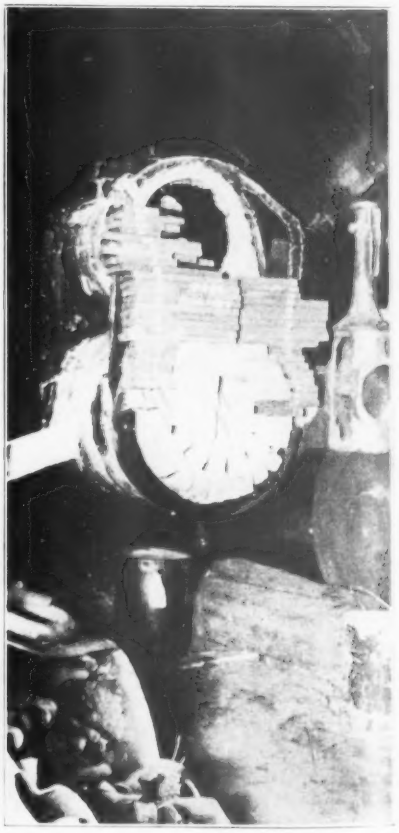


Fig. 5. The Use of Carbon Blocks.

lent welding. After a period of 15 years he found that he still had an indefinite amount of problems to solve before he could conquer the art of welding. By solving some of the intricate operations he daily found new joys and enthusiasm that made his work very interesting. While battling continuously to discover some of the hidden treasures of the various welding processes he finally was able to discover a new method of reclaiming large defective castings without dismantling from their position, with the aid of the oxy-acetylene blowpipe.

Brother welders, look at figure 1. It represents a large locomotive cylinder that was broken at the valve and steam cylinder, about 11 inches deep in the broken piece that was lost. It included all the port holes, two bores and the exhaust chamber. At the first glance you will not believe that this cylinder could be welded. I thought so, too, but at a second and third glance I began to see a dim light, a tip or rather a small possibility of performing this operation. I studied for about six hours to enlarge the possibility of success and finally succeeded in making the necessary program from start to finish for this operation. It required 38 hours to prepare the cylinder and 51 hours of continuous welding. To realize the intricacy and size of the operation, one can see in figure 2, a similar cylinder not broken and one may judge for himself the new possibilities such an operation opens up for the welding trade. In order that the readers may believe that such operations are possible I will outline my method of welding and then one can see and believe from this new method that oxy-acetylene welding operations have no limit and what we believe to be impossible today may be performed successfully tomorrow.

Method of Welding.

This operation had to be performed in three welds or rather heating it three times.

In the first operation as shown in figure 1, we build a fire clay core so as to form all the necessary port holes and bridges in the steam and valve cylinder. This core was made of fire clay mixed with two per cent borax and one per cent granulated glass to prevent it from cracking. Then we have shaped carbon blocks to fit around the fracture and core, leaving the necessary space for the fusing of enough metal so as to build up the face of the steam cylinder and a four-inch extension of the valve cylinder. These carbon blocks were one inch thick, so we could advance from bottom up, one inch at a time on each side of the cylinder, having for this purpose two operators, one on each side and meeting together when the top of the valve cylinder was reached. After these carbon blocks were cut, shaped and numerated from 1 to 46 right and left, they were set aside on a bench in proper order so they could be handled promptly and in numerical order. A platform was built of a piece of flat iron 26 x 6 x 1 inches, with a pipe supporting it at the center, and placed one inch lower where the fracture started at the steam cylinder as per figure 3. On this platform we rested the layers of the carbon blocks. Then the opening of the steam pipe to the valve cylinder was well closed with fire clay and supported with fire bricks so as to retain the heat in the furnace.

The next operation was the building of a furnace and the preheating, which was done as follows: A wooden platform was built directly under the cylinder and across the pit, which was covered with sheet asbestos. On top of these we laid two layers of bricks packed with fire clay (so no heat could get through), then the bottom of the cylinder was well supported in three places with columns of bricks, on top of the brick platform, so the cylinder would not sag when hot. Then we built our walls out of double fire bricks layed in crosssections and as high as the cylinder, leaving at the bottom and sides an eight-inch or more fuel displacement. Three large holes were left open and covered with heavy sheet asbestos for the purpose of fire doors, to feed fuel when necessary and also to enable the operators to perform their operation. Two holes were left on each end of cylinder and the third hole was made on the right side of cylinder. The necessary draft was obtained by separating the first row of bricks on top of the brick foundation, about one inch apart on all four sides of the furnace. The furnace was then filled about half full with charcoal, eighty per cent, and coke twenty per cent and the top of the furnace was covered also with heavy sheet asbestos. Our night man then kindled the furnace about 1 a. m. through the draft holes and welding was started next morning at 10 a. m. The first (No. 1) carbon blocks were then set on place on the iron platform and with two oxweld (No. 15) welding heads we soon got the space filled up and united with the fractured wall. To increase our efficiency, about 200 pounds of short pieces of cast iron rods was prepared to feed into the molten mass of metal and paddled with long welding rods by the operator. Thus we advanced pretty fast one layer on top of another and by 6 p. m. our night welders relieved the

Fig. 7. Second Operation with New Fire Clay Core.

day men, continuing the same operation and they got through about 6 o'clock the next morning. One helper handed the long welding rods to the operators, fed the small rods, flux, fuel in the furnace and drinking water for the operators. The furnace was then closed at the front and left to cool for 12 hours and then the second operation began. The iron platform was then raised up higher, about one inch lower than the valve cylinder, and again filled about half full with fuel kindled at night and in the morning one layer of carbon blocks was laid to weld a 1½ x 7-inch thick cast iron bottom for the valve cylinder and exhaust chamber. This operation was finished in about three hours and then again left to cool for twelve hours.

At the third operation we built a second core to make up the front of the valve cylinder and the space for the exhaust chamber, new carbon blocks were cut and shaped so as to

fit where we left off welding and around the new core, leaving all the necessary space for fusing enough metal to make up the second bore and the front wall of valve cylinder and exhaust chamber complete. These carbons were also numerated and set on the same order as in the first operation. The welding was started the next day about 6 p. m. and finished on the following morning about 9 a. m. and the job was completed. After the welding operation all the draft holes and small crevices were closed with fire clay and left to cool for eighteen hours.

Although we found two loose sections in the welds and it will require dismantling and another five hours welding, nevertheless it was the first of its kind.

This operation opened our eyes a little further to discover a great new field where any large casting, regardless where and how it is broken, could be welded cheaper and better than the so-called free hand welding.

The writer is not satisfied yet with the greatest possible speed that he has yet attained in building cast iron metal. He is working on a method where a sort of crucible can be placed near such a welding operation and hot melted cast metal should be poured in the carbon molds and paddled in so as to unite with the bottom and fracture with the aid of a powerful blowpipe and the long welding cast iron welding rod.

Do not forget, brother welders, that your profession had just reached its youth and now it is absolutely necessary that we as guardians of this process have not only to stop blundering, but to take better care of it and develop this youth into a great established and powerful reclaimer of our nation's broken machinery.

THE HAZARDOUS USE OF OIL IN CONTACT WITH OXYGEN UNDER PRESSURE.

By B. C. Condit, Chemist, Burdett Manufacturing Company.

"We learn by experience." The truth of this rather trite phrase has been only too well illustrated in the case of the above subject. A few men have "learned by experience" that oil in contact with oxygen under pressure is not a desideratum as far as establishing a good margin of safety of operation is concerned, and even now blunders are made which must be laid to lack of consideration of the reactions involved in the selection of a safe lubricant for compressors and valves in contact with oxygen under pressure.

The chemistry involved is comparatively simple. Oxygen is in itself a powerful oxidizing agent. Every oxidizing agent as such is capable of being reduced, as we say chemically. This accords with the first law of energetics, commonly called the Law of the Conservation of Energy. This law states that no energy is ever lost or gained, or more concretely, energy which is given up at one point in the system under change simultaneously appears at some other point or points in that system or its surroundings in another form or forms.

Therefore in the reaction under consideration we are dealing with an oxidizing agent and must consider the possibilities of its reacting with a certain liberation of energy in the formation of an oxidation product. Our first consideration, then, in the choice of a lubricant for oxygen valves should be to ascertain if this lubricant is susceptible to oxidation and the consequent liberation of the heat of formation of the oxidation product.

A lubricant can be defined as any substance applied to machinery or any rubbing surfaces to diminish friction. Lubricants fill the interstices between the particles of the surfaces in contact and so prevent their interlacement. Tallow is used where the rubbing surfaces are of metal and wood, and even when they are both metal, if they happen to be rough. Oil is more commonly employed for metal surfaces in general, and the harder and smoother the surfaces the finer must be the oil. Powdered plumbago has been used for highly polished surfaces. Water is found to be a good lubricant at all rubbing surfaces under water. Very many other substances are also in use as lubricants, such as cottonseed oil, olive oil, sperm oil, castor oil, and other vegetable oils. Hard lubricants include graphite and soapstone.

The term OIL is used for substances differing widely both in composition and properties. In this discussion however reference is made particularly to FATTY oils. These fatty oils are usually classified by arranging them according to what is called their iodine value. The iodine value is the percentage of iodine chloride, which is absorbed by the oil, expressed in terms of iodine. All commercial oils are rated in this manner, which shows that they are more or less unsaturated oils and capable of absorbing oxygen to become saturated. In this respect they act precisely like a sponge. Inasmuch as the magnitude of the iodine value stands in close relation to the absorption of oxygen, or in other words to the drying power, we have here the keynote of the hazard discussed in this article.

A very important consideration to be observed in choosing a lubricant is, that it should not absorb oxygen from the air, forming a gum which would increase the viscosity, or turn rancid, and attack the metal with which it is brought in contact. This liability to oxidize is shown by the "gumming test" in the case of oils.

In the case of oxygen under pressure, we have this situation magnified several times. Instead of absorbing oxygen from the air, which contains only 21% of oxygen, we have large quantities of oxygen in a very pure condition available for this reaction.

The reaction possibilities vary under different conditions which influence the equilibrium change. When oxygen combines with oil, there are two reactions which occur when the oxygen is under pressure. Instead of being quietly absorbed with slow evolution of heat, the oxygen is quickly absorbed with consequent sudden evolution of heat. This reaction quickly attains its maximum point and is maintained by the excess oxygen available. The actual heat developed depends on the nature and quantity of oil present. The following Table gives some concrete examples.

TABLE SHOWING QUANTITY OF HEAT LIBERATED IN COMBUSTION OF OILS WITH OXYGEN.

Name of Oil.	Heat Liberated Small Calories
Paraffin oils	11,000
Lard oils	9,469
Vegetable oils	9,500

Of course some lubricating oils are mixtures but the grand majority can be said to liberate from 9,000 to 11,000 calories of heat per gram when oxidized. This means that if one gram of oil is used to lubricate the valve of an oxygen cylinder, that gram of oil in coming in contact with the oxygen is capable of liberating approximately 10,000 calories of heat. This is sufficient heat to raise the temperature of one pound of water 40 degrees Fahrenheit.

This quantity of heat is also sufficient to raise the temperature of one pound of oxygen (11.2 cubic feet) 160 degrees Fahrenheit (assuming that the specific heat of any gas remains constant at all pressures and temperatures).

This will vaporize the oil under reaction which will thus remain in the gas as a combustible capable of explosive reaction, and if raised beyond the flash point of the oil, may ignite.

In the commercial production and use of oxygen there are three main points where high pressure valves are employed. These are:

1—On the compressor, where the oxygen is pumped through the charging stand into the cylinders for storage and transportation.
2—On the charging stands, where the gas is passed through a suitable manifold to the cylinders.
3—On the cylinders themselves.

In each of the above instances, special precautions must be observed. On the compressor, valves must be repacked if they contain a lubricated packing material, before they can be used for oxygen. This can be accomplished by removing the packing in the valve and substituting an unlubricated packing. This material can be cleaned with ether or carbon tetra-chloride in order to remove any grease or oil. It should be noted in this connection also that greasy hands constitute a source of oil, and packing can be contaminated in this manner. As a rule, asbestos is good for this work and should be as free as possible from mineral oil.

On charging stands, valves, with the exception of the master valve, are the same as the valves on cylinders. When purchased, these valves frequently contain lubricated packing. This must be removed, the valve thoroughly cleaned with carbon tetra-chloride, and suitable packing, if any, inserted in its place.

All piping must also be freed from all traces of oil or grease before oxygen gas is passed through same. This may be present from use of oil in cutting the threads on the pipe. One or two drops of an oil of high absorption capacity for oxygen on being vaporized may cause an explosion or start combustion, which, when propagated throughout the system, would result in serious damage.

On the cylinders, particular care must be taken to see that no lubricant with a capacity for absorbing oxygen is present in the valves, either in the packing or as a lubricant for moving parts. Too much attention cannot be given this factor, because therein lies a grave element of danger. Oil on a cylinder valve coming in contact with oxygen will be vaporized by the heat of the attendant reaction, and this oil vapor in the oxygen is liable to combustion. A later article will contain the results of some experiments conducted along this line in the Burdett Laboratories.

Regulators are also subject to the same restrictions, and should be kept free from oil at all times. Necessary cleaning of the regulator can be accomplished by the use of carbon tetra-chloride. This is non-inflammable and non-oxidizable and consequently is better for this purpose than ether or gasolene.

Workmen who oil an oxygen valve in a shop are not only risking their own life, but are endangering the lives of their fellows. A mistake may be made through ignorance and as such might be pardoned in some cases; but anyone who deliberately oils an oxygen valve knowing the dangers attendant thereon, is criminally responsible for the result.

Oxygen under pressure is a powerful factor in industrial operations and when properly handled, is an obedient servant. When improperly handled, however, hazards develop precisely as in other industrial operations. Consequently in handling oxygen under pressure, find out the safe method of procedure and then go ahead.

Would you insert a lighted match into a barrel of gasolene? Then use the same judgment, and DO NOT oil an oxygen valve.

SUMMARY.

1—Oil in contact with oxygen absorbs same with liberation of heat.
2—This heat is sufficient to vaporize the oil and in some cases to raise it above the flash point.
3—This vaporized oil is liable to produce an explosive mixture with the oxygen.
4—Valves and piping in use with oxygen should contain no oil. These can be cleaned by methods specified.

EXAMINING BLACKSMITHS.

The blacksmith is playing a most important part in the great war, and he is serving his country both in the army, navy and aviation department. The accompanying illustration shows two candidates for enlistment in the aviation corps of Canada. They are being given an opportunity to demonstrate their familiarity with blacksmith work by means of the motor truck, which is equipped with a special body containing the tools, machinery, etc., as shown. As may be noted, the equipment includes an oxy-acetylene welding outfit as well as a lathe, etc.—Blacksmith & Wheelwright.

Blacksmiths Enlisting With Aviation Corps Are Required to Pass an Examination.—The School Travels on Wheels, a Motor Truck Being Utilized.

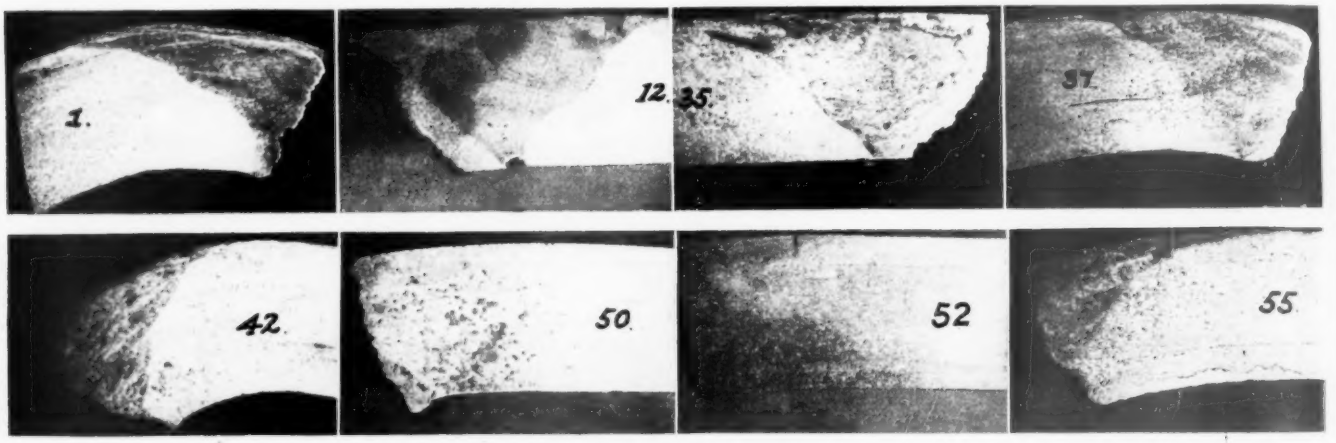
Mr. F. E. Totten, a well known instructor of Kansas City, is in the Baxter Springs Hospital, Baxter Springs, Kansas, with a broken leg, the result of the careless driving of a motor truck driver. Mr. Baxter was responding to a hurry-up call for a welder and met the truck on the wrong side of the road.

TEST DEPARTMENT

Final Report of Second Lot of Test Welds Submitted to The Welding Engineer

The second installment of test welds, submitted to *The Welding Engineer* under the plan announced in the November, 1917, issue, have been inspected, with the results shown in the accompanying table and illustrations.

For the benefit of those readers who have but recently become subscribers, it might be of interest to state that for the sake of uniformity all test pieces were furnished, on application, by *The Welding Engineer*. The pieces consisted of two pieces of ½"x2" tank steel, beveled and ready for welding. Under the terms of the trial the welds were made from one side, were not annealed, and were reinforced not more than 1/16 inch, and not ground.



Section of welds, magnified twice. Note variety of locations of fractures.

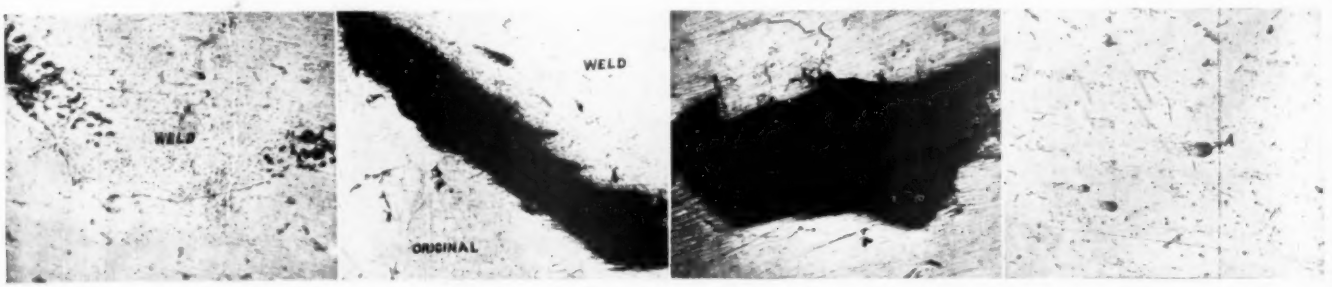
Of the eighteen pieces reported in the January issue, but one test piece fully measured up to the requirements.

The first thing done was to examine the specimens carefully with a small magnifying glass, and the general appearance is described in the table. The piece was next ground off to the same thickness as the original metal and clamped to an anvil with the bottom of the weld at the edge of the anvil, and bent over by successive blows of a twelve-pound sledge. Care was taken to round the edges at the point of bending to about 1/16-inch radius to avoid starting a crack at the sharp edge. A number of specimens broke under this treatment before they had reached a right angle bend. Others stood the bending until the sides were parallel, and the amount of such bending is indicated on the sketch attached. Such as did not break under this test were reversed, and, in every case they broke at the first blow.

An examination of the fracture was carefully made to notice any defects that might exist, and in all cases where the weld was noticeably defective nothing further was done, the idea being that it is useless to make any further tests of a weld not sound. The idea is that what is wanted to determine is how to make a sound weld, and if the welders are to obtain good results this is the first thing they must strive for. After they are successful in this direction further examination should be made of the qualities of the weld which cannot be determined by the examination of the fracture with a hand glass.

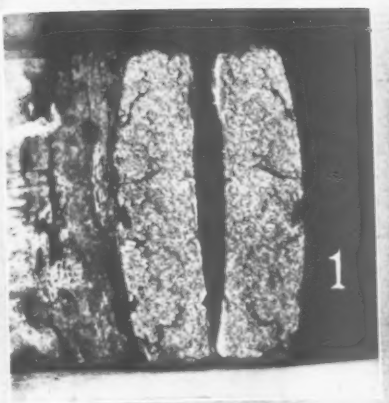
In the cases where the welds appeared clean and sound the examination was carried further by polishing and etching a section and examining it under the microscope. In some cases this disclosed imperfections that should not exist and which detract from the strength of the weld.

No. 1 No. 37 No. 42 No. 52



Test piece No. 1 shows 1-3 of only serious defect. Slag, streak and lap part of lap between original and weld. Magnified 200. No. 42 shows only gas pockets ("A") in weld and small amount of oxide. A very good on line of weld. Small black dots are oxide. Magnified 200. No. 37 shows defect in section, lap on line of weld. Magnified 200. No. 52 shows a few structure.

The general results of the second lot are the same as in the first. It will be noticed that the welds have the same type of defects. Number one is the best one, but not quite equal to number thirty of the first lot. Numbers thirty-seven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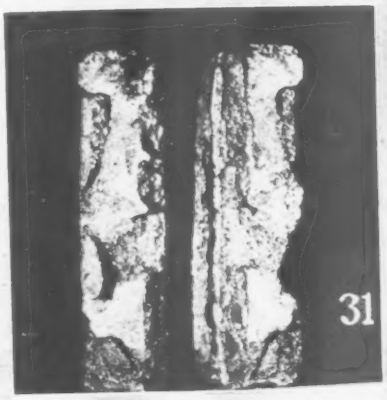
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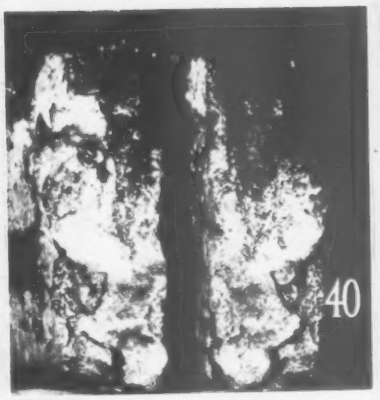
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42

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52

55

fifty-two and fifty-five are fair, but the defects at the outer edges of the V's are unnecessary, and a little care would avoid them.

There is nothing special to say about the welding wires used, except as noted in the table. There were two cases of wire higher in carbon than usual, but as the welds made with these were not sound, no conclusions can be drawn as to the effect of this increase in carbon.

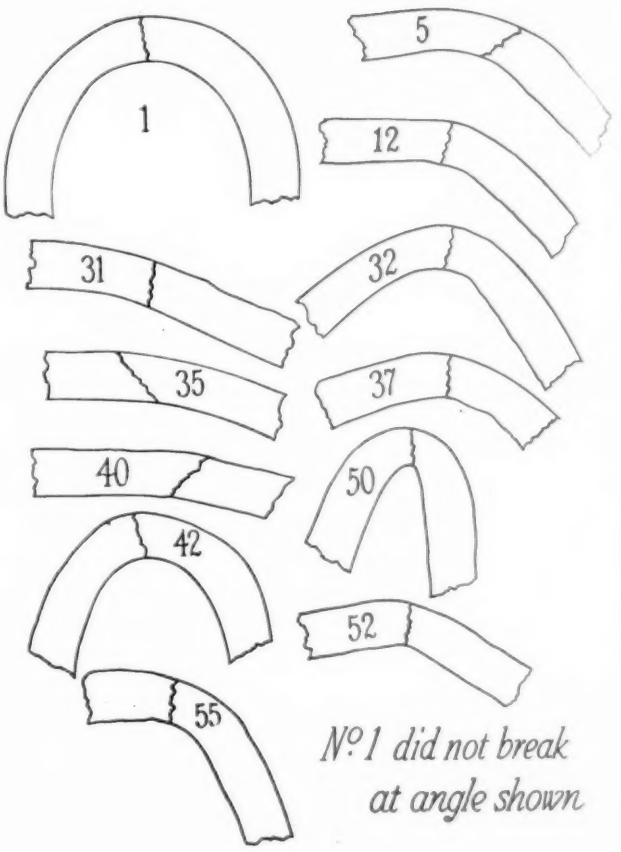
The microphotographs show about the same defects as before and emphasize the need of the welder paying strict attention to his work at all times. There is no need of such defects, and as they are not common in the welds from which the sections were taken, it indicates that a little more care would avoid them entirely.

It should now be evident that the bending test is a very searching one, and that if welders would use it more for their own information, they would better their work.

It is believed that some of those who submitted samples thought that tensile tests would be made of their specimens, although we may be wrong. It should be clear to anyone that had this opinion that there is no use in spending time in machining test pieces, until it is reasonably sure that such test pieces will be sound and clean, even under microscopic examination. Welds that are not microscopically sound will not give good results in tensile tests; and any that are noticeably defective in this respect give poor results in the bending tests.

Again, a tensile test is not a good criterion of the quality of a weld. A sound weld will always have enough tensile strength, but its resistance to alternating stress and shock are limited. This is a big subject, and needs much investigation. It is enough to say that until consistently sound welds can be produced by any welder, it is useless to apply any refined tests.

The report in the final lot of test pieces will be published in the April issue, if the report can be finished in time.



Specimen	Torch	Size Tip	Size and Kind of Wire	Width of Weld	Through at Bottom of V	BEND TEST BLOWS			Appearance of Fracture	Remarks
						To Crack	To Break	To Break on Reverse		
1	Smith	6	3/16" W. I.	1¼"	Except ¼"	—	35 N. B.	1	Fine grained, clean and sound.	Good weld. No cracks on outside.
5	Eastman	5	3/16"	1 3/16"	No	7	12	—	Broke loose along one side of V, but broke through center of weld.	Tips too small. Full of gas pockets and bad laps on one end at top of weld. Not through by 1/16".
12	D. B. Cl. B.	7	¼" W. I.	1¼"	No	5	9	—	Fine grained. Only 1-3 of weld sound.	Welding wire has too much slag in it.
31	Austin	4	3/16"	1⅛"	No	3	6	—	Broke through one side of V, cracked at other side.	Two-thirds of depth not welded.
32	D. B.	8	3/16"	1⅜"	Not in Places	14	29	—	Broke through lap and center of weld. Fine grained.	Edges of weld and top not filled up. Lap all across ⅛" from top.
35	Dyer	7	⅛" Steel	1 1/16"	Except ¼"	5	9	—	Both ends of V on one side not welded. Large lap in center.	Wire higher in carbon than usual, about .25c. Ends of V not welded.
37	Oxweld	10	¼"	⅞" to 1⅛"	No	13	15	—	One large lap in bottom of V.	Surface not flush. Wire about .25c. Gas pockets and oxide at one end of V.
40	P. O. L.	6	¼" Vanadium Steel	1½"	No	3	4	—	Broke mostly through one side of V.	Not through by ⅛". Full of laps.
42	D. B.	7	3/16" Steel	1½"	No	13	35	—	Edges broke after center. Sound in center.	Ends had gas pockets and slag.
50	D. B.	6	Low Carbon 3/16" W. I.	1¾"	Yes	5	18	—	Sound in center. Bad at edges.	Both ends of V had gas pockets and slag.
52	D. B.	7	3/16" W. I.	1½"	Except ½"	8	10	—	Laps in ends of weld. One lap in top of weld. Rest of weld sound.	Ends of weld had laps and slag.
55	D. B.	6	3/16" W. I.	1¾"	Except ½"	13	18	—	Laps in ends of weld. Rest of weld sound.	Ends of weld full of gas pockets and slag on top. Broke in center first.

A FLOATING WELDING SHOP.

...tates, and at 'em! There's a good ship in the offing ...stress signals. We don't know what's the matter, ... a welding job, then the good welding ship Albert C... the job."

...s the daily life of the watch on duty with the Ma... Welding Tug "Albert C.," owned and operated by The St... rence Welding Co., Limited, 138 Inspector St., Mon... Mr. A. M. Barry, Managing Director. The tug is used ... around the port of Montreal for Electric and Oxy-Acetylene welding and cutting. The boat is fully equipped to handle all kinds of boiler repairs, also a large 12x12x12 Westinghouse Locomotive Type Air Compressor. The company is now entering the second season with this outfit, 1917 being a very prosperous year, the tug working on an average of 100 hours per week.

BIG SHIPS CUT IN TWO.

A feat that is amazing to the layman is being performed on the Great Lakes, where mighty ore carriers that ply ordinarily between Duluth and the ports of Lake Erie are being cut in two so they may pass through the Welland Canal to the Atlantic and put into service in war trade. It is impossible for these vessels to be taken through the canal as they were built. Engineering science solved what would seem to the layman an insurmountable problem. These monster vessels are divided in the middle by an acetylene flame; the open end inclosed and half of the ship is taken through the canal. The other half follows and, in the St. Lawrence, the two are joined together again.—Emergency Fleet News.

The Latest "Chaser."
Not a Submarine Chaser, But a "Trouble Chaser." Owned and Operated by the St. Lawrence Welding Co., Montreal, Quebeck.

THE DEVIL HAS RESIGNED.

Satan, in Letter, to German Ruler, Informs Him He Has Ousted All Other Evildoers From Pinnacle of Infamy.

Louis Syberkrop, of Creston, has acquired much fame in recent weeks as author of a satire on Kaiser Wilhelm. Requests have come to him from Tumulty, Secretary Daniels and Roosevelt, and people in every state of the Union and in Canada have asked for copies of Mr. Syberkrop's article. It is:

"The Infernal Region,
"June 28, 1917.

"To Wilhelm von Hohenzollern, King of Prussia, Emperor of all Germany and Envoy Extraordinary of Almighty God:

"My Dear Wilhelm:

"I can call you by that familiar name for I have always been very close to you, much closer than you could ever know.

"From the time that you were yet an undeveloped being in your mother's womb I have shaped your destiny for my own purpose.

"In the days of Rome I created a roughneck known in history as Nero: he was a vulgar character and suited my purpose at that particular time. In these modern days a classic demon and efficient super-criminal was needed and as I know the Hohenzollern blood I picked you as my special instrument to place on earth an annex of hell. I gave you abnormal ambition, likewise an over supply of egotism that you might not discover your own failings; I twisted your mind to that of a mad man with certain normal tendencies to carry you by, a most dangerous character placed in power; I gave you the power of a hypnotist and a certain magnetic force that you might sway your people. I am responsible for the deformed arm that hangs helpless on your left, for your crippled condition embitters your life and destroys all noble impulses that might otherwise cause me anxiety, but your strong sword arm is driven by your ambition that squelches all sentiment and pity; I placed in your soul a deep hatred for all things English, for of all nations on earth I hate England most; wherever England plants her flag she brings order out of chaos and the hated Cross follows the Union Jack; under her rule wild tribes become tillers of the soil and in due time practical citizens; she is the great civilizer of the globe and I HATE HER. I planted in your soul a cruel hatred for your mother because SHE was English and left my good friend Bismarck to fan the flame I had kindled. Recent history proves how well our work was done. It broke your royal mother's heart, but I gained my purpose.

(Continued on Page 36)

TRAINING SOLDIER WELDERS.

By Lieut. Lorn Campbell, Jr., O. R. C., U. S. Army.

IN THESE days of war, and preparation for more war a general interest is being taken by all welders in the methods of the government in meeting the great demand for welders to be used in the various departments of the army. To give some general idea to those who are not already familiar with the situation, this opportunity is taken to outline what is being done in one particular branch of the service and to overcome the general belief that the government is not awake to the great demand for oxy-acetylene operators.

The army may be likened to a large industry, such as may be found in all parts of the commercial world, and it has had to be educated as to the use and application of the oxy-acetylene process. Possibly the first real awakening as to the possibilities of this great art was brought out in the past Mexican fracas, when motor trucks were first called into play to replace the horse and mule. In theory it may be

Lieut. Lorn Campbell, Jr.

all right to assume that all replacements which are necessary for repairs may be carried in stock, but the welder realizes that such things as broken auto frames, broken water jackets on cylinder blocks, etc., are truly a welder's job. This proved to be the case along the border; for while there were many replacement parts on hand, yet, at one time there were ten of fifteen trucks out of commission on account of lack of repairs. Welding was not then really known to the officers in command, but in order to determine whether the process could be applied to their repairs, it was decided to have a welder from a near-by town brought on the job, the result of his efforts being noted. Fortunately for the entire industry this man was a very skilled operator and had the whole ten trucks back in service again within two days. He was then kept on hand and his services utilized daily in the repair and maintenance of all trucks. With the general motorization of all Mobile Forces, for overseas duty, the care and repair question brought the subject of welding to the fore and the process has gradually come into its own and today every repair truck and base depot had been equipped with oxy-acetylene welding and cutting units of the very latest type. In the new National Army, the major part of the Commissioned Personnel in the Ordnance and Quartermasters Corps, are alert automobile engineers and executives who are already quite familiar with the value and application of welding, and are continually calling their various Department's attention to the requirements, so far as the operators are concerned, for they, in their civil life have realized to what extent they relied upon these same operators. In order to acquaint not only the enlisted men, but the officers as well, with the details and repair of all tractors and trucks used in the various parts of the service, the Ordnance Department has established what is known as Motor Section Instruction Schools, where intensified training is given in various parts of the apparatus to be used overseas. It is in this Department that welders are being trained and equipped for service.

There have been many suggestions made concerning the training of Oxy-acetylene Welders, but the Commercial World as a whole has never been active in meeting the shortage of skilled operators. The Ordnance Department is now taking men who have had little or no training in welding, and turning them out as all-around welders, in thirty days of intensified training. To the welding trade this will seem a very short period in which to train a man in this particular line, but the results that are being secured are very satisfactory and the officers in charge are very well pleased with the interest taken by the students and by the co-operation of the manufacturers of apparatus, who have offered many suggestions and helps in getting the course under way.

Thirty days is naturally a very short time in which to turn out an Oxy-Acetylene operator, but the course of instruction differs considerably from the general impression of Oxy-Acetylene instruction, insomuch that the student applies himself at first only to the welding of specimens, which are immediately broken and tested in every possible manner. The interior of a weld being the true index as to the character of the weld, and to the welder's ability to handle his metal, flame and filler rod. This method is used on cast iron, steel, malleable iron and aluminum, in the order named, and as soon as a student is capable of handling one particular metal to the satisfaction of his instructor, he is then placed on more complicated jobs and taught the effects of contraction and expansion of this particular metal, which next to the actual fusing of the metals, is the whole secret of the successful welder. All applications cannot possibly be taken up in the short time this course covers, but the daily lectures and chalk talks given by the instructors cover expansion and contraction in a general way and starts the student's mind thinking along the proper channels, so that when various jobs are brought in, the student will know very quickly what kind of metal he is to work on, the kind of filler rods to use and whether preheating is necessary or not. The work which the students have in the shop are the parts of the tractors and motor-trucks which the manufacturers have either discarded or wish to reclaim and are the same that will be encountered overseas back of the line; so that in this way these welding students become very familiar with the parts and jobs which they will be expected to work on, when the time comes.

Many of the men received as students already have had some training in welding and are possibly very well versed with cast iron and steel welding, but do not know how to handle malleable iron, brass or aluminum, while with others it is quite the reverse. These men are trained in the usual manner, emphasis, however, being laid upon the metal which they do not know. Other men are not acquainted with welding at all, but have had some mechanical training and have found that welding appeals to them and appreciate the opportunity to learn such an interesting as well as profitable trade while in the service of the government. All day is

spent in the actual welding itself and in the evening the men devote their time to writing up their lectures and reading text books which have been issued to them, or drawing literature from the library, which the instructors have accumulated at each of these Ordnance Welding Schools.

Accurate status cards are kept of each welder's efforts in the schools concerning his actual welding work and his ability shown in portraying his thoughts on paper, in order to best place him in the service in the capacity which he is suited for. In many cases while a man may be a first class

Major Roy A. Shaw.

welder, he may not be capable of expressing his thoughts to others and therefore he would not do as an additional instructor, whereas, the man who can, is generally used as an instructor at some other school. There are many opportunities for welders in every branch of the service and if additional information is desired concerning enlistment, or otherwise, same will be very gladly answered by the Commanding Officer of the Motor Section Instruction Schools, Military Headquarters Holt Tractor Mfg. Co., Peoria, Ill., attention Oxy-Acetylene Welding Dept.

It is the desire of the officers in charge of these welding schools that as much co-operation be obtained from the Oxy-Acetylene world as possible, for it is to its advantage as well as the government's to turn out efficient operators and any suggestions for intensified instruction; any new processes; literature; or other data which could possibly assist in producing efficient welders will be very gratefully received at the above address.

The reader will gain some idea of the evening lectures given welding students by reading the following outline of lectures, which will be published in the April issue of The Welding Engineer. These lectures are the same as are being used in other branches of government service and were prepared by and furnished to the government by the U. S. Welding Co., Minneapolis, Minn.

Major Roy A. Shaw.

ROY A. Shaw, a prominent member of the trade and a very active participant in the affairs of the International Acetylene Association, has been called to the service, being commissioned a Major, Quartermaster Corps, National Army. He is in charge of Supply Control Division, office of the Quartermaster General, Washington, D. C. He took up his duties the latter part of February, upon the request of Mr. R. J. Thorne, of Chicago, who is assistant to General Goethals, Acting Quartermaster General.

Major Shaw was at one time sales manager of the Acetylene Apparatus Mfg. Co., and later manager of the Oxweld Acetylene Co. About four years ago he was elected vice-president of the Union Carbide Sales Co.

First. Lieut. C. K. Rickel.

LIEUT. Rickel was the second member of the firm of Campbell & Rickel, and he was an officer of the United States Welding Co. He was born July 2nd, 1890, and was educated at the University of Minnesota. He entered the second officers' training camp at Fort Snelling and was commissioned a First Lieutenant of Infantry. In February of this year he was transferred on request to the Ordnance Department and has been assigned for duty to Motor Section Instruction Schools, Ordnance Dept., Peoria, Ill.

Lieut. Cyrus Kennedy Rickel.

First Lieut. Lorn Campbell, Jr.

LIEUT. Campbell first became interested in the welding business as a partner in the firm of Campbell & Rickel, jobbers of apparatus, Minneapolis, Minn., which firm later became the United States Welding Co. He was born May 1st, 1891 and was educated at the University of Minnesota. He is on duty at Motor Section Instruction Schools, Ordnance Dept., Peoria, Ill. A photograph of Lieut. Campbell appears on page 22.

Hints for the Welder

When you finish an interesting piece of work, can you set down on paper the manner in which you went about the job, how you prepared the work and how the job was done? Have you learned some little stunt every welder ought to know? Contributions to this department are paid for. Write it down any old way—I'll polish it up. Make a rough pencil sketch and our draughtsman will fix it up fine. Line drawings are more practical than photographs. Do it today—the men on the firing line are waiting.

L. B. Mackenzie, Editor.

WELDING STELITE.

Editor:

The problem of welding Stelite has come before me. What information can you give me? I have some Stelite to weld on carbon shanks. What welding stock shall I use and how will this compare with welding high speed steel?

D. J. Duke.

Answer:

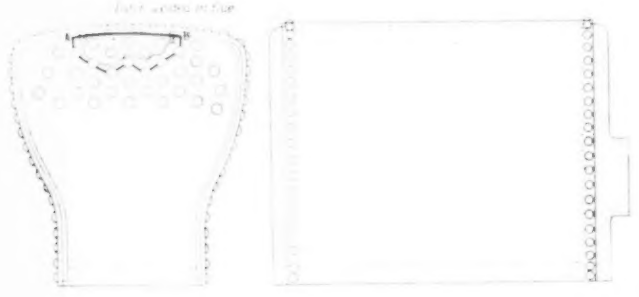
To weld Stelite to mild steel shanks, proceed as follows:

Mix some fire clay with a little borax and granulated glass and set the stelite plate on a 1-inch thick layer of fire clay, then build up about ⅛-inch metal on the side to be welded, using a ⅛-inch nickel steel welding rod and a cleaning powder used for cast iron mixed with two percent of sal ammoniac powder. Then preheat the shank at the edges to be welded to a cherry red and set the stelite plated, attached with the fire clay if possible, close to the shank and weld the sides with the same welding rod. No cleaning powder is necessary for the latter operation. If the fire clay breaks during the setting of the stelite to the shank a new layer about 1 inch thick may be replaced. Editor.

FLUE SHEET EXPANSION.

Editor:

Enclosed please find sketch of front flue sheet of locomotive fire box. Note on sketch where patch has been welded in. We do not understand just how to take care of the expansion and contraction, the weld cracks at either end marked A' A". This patch is 24" long, 8" wide.



Please advise us as how to weld this flue sheet to be successful. C. R. Coen.

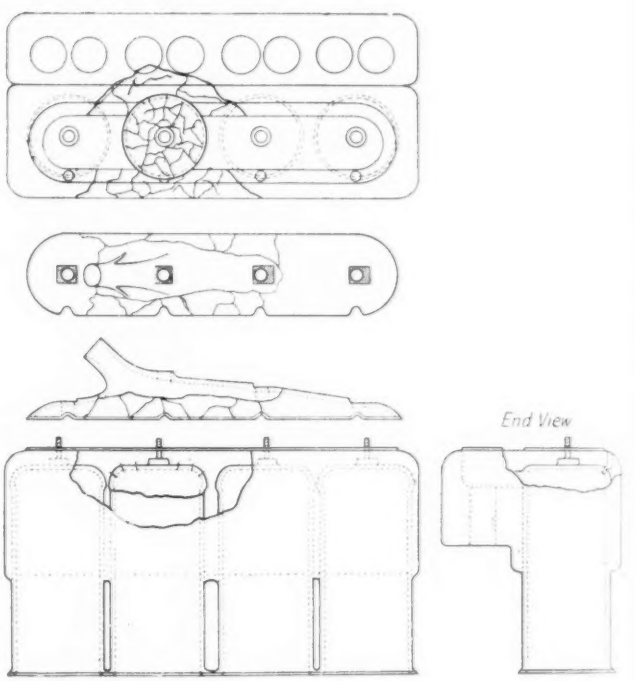
Answer:

Your trouble was caused by trying to avoid bridge welding and the way the patch was laid out you were bound to have no success. I have marked with dark pencil the way this sheet should have been cut and patch inserted. Weld from A to B and then weld all bridges and I'll warrant that expansion won't bother you. This method is being used in several large R. R. shops with entire success. Editor.

ENGINE CYLINDER.

Editor:

The enclosed sketch shows an engine cylinder, which was badly broken by the piston crank bolts becoming detached and the piston shooting up through the inner and outer walls of cylinder block. The inner wall immediately over the piston was broken into 27 pieces. These were carefully fitted together and welded by the oxy-acetylene torch into one piece, to fit as closely over the inside wall as possible, and then the whole inside wall was welded into place. After which the outside wall was built up, and lastly the water intake cap was fitted together. The whole job was prepared and welded, after which it was tested in 7 hours work. Although a wreck like this would at first sight appear beyond repair, the engine is apparently as strong as ever and is giving service every day without any apparent effect or loss of power. J. Raymond Fuehrer.



MAKING A STOVE.

Editor:

I am sending you three sketches I hope will do somebody some good. I have one of the stoves (Fig. 1) in operation and have orders for several. Stove is made of a carbide can

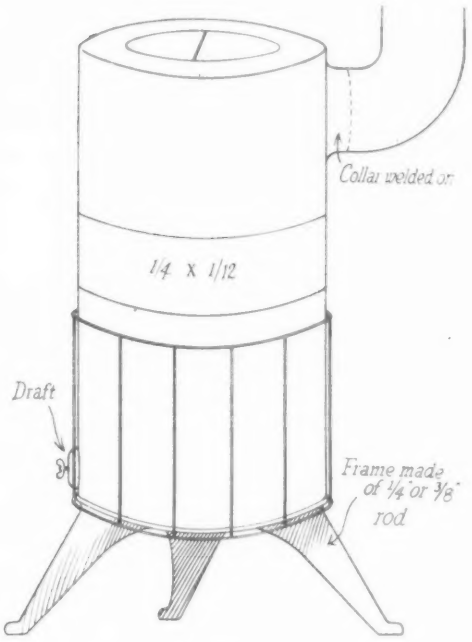


Fig. 1.

and a few scraps of 3/8" or 1/4" iron rods. This heater works well and is not bad looking for shop or office.

The process of keeping the Ford cylinder block cool (Fig. 2) is easy. When brass tubing is not to be had use an old

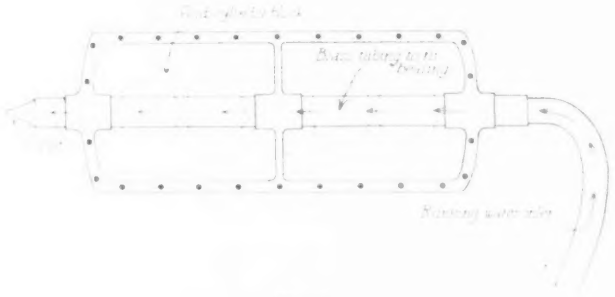


Fig. 2.

pump casing, turning it in the lathe to fit bearing. Couple hose to one end and then to faucet. Make about 3/8" hole in outlet end to allow just enough water to flow to keep cool.

Relative to Fig. 3. Put preheating burner in manifold so

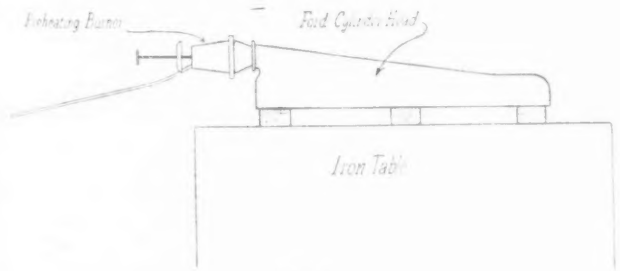


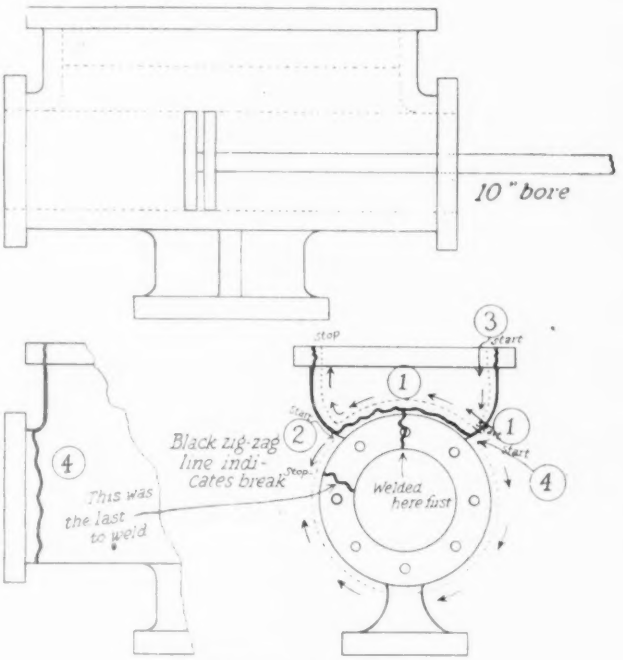
Fig. 3.

that flame strikes heavy part of casting. When beginning weld allow it to heat and just before the upper part of the manifold begins to show red make your weld. By this time the whole head is red. Now turn your burner down just a little and when very dark red, a little more, and so on until out. Then turn head upside down, covering manifold in warm ashes or sand, leaving top side open to cool.

W. B. Hunt.

WELDING A CYLINDER.

The accompanying illustration shows how J. D. Leveille, Westfield, Mass., handled a difficult job without the use of a charcoal fire.



Welding by J. D. Leveille.

HEAT PRODUCTION IN ARC.

Dear Editor:

Have noted the comments of Mr. S. W. Miller with regard to article on "Heat Production in the Electric Arc." Mr. Miller has attempted to draw some conclusions from the tensile strength of the specimens tested. We drew no conclusions from these figures. Our conclusions were based entirely upon whether the specimen broke in the weld or outside of it. In every case where the specimen broke in the weld, the cause was incomplete fusion of the entire section.

With regard to the Type "A" or full bevel test pieces, would say that we were entirely correct in that all of them broke outside of the weld. It is true, specimen 3 broke within the white lines, and yet it was outside of the weld. As far as these specimens are concerned, nothing at all was learned where the specimen broke outside of the weld. We knew simply that the weld was stronger than the material, all being finished to the same section. However, where the break was inside of the weld, we were able to determine the character of the weld and the degree of penetration. The only reason that the type "A" unit showed up a greater strength as compared with the material than some of the other joints was that in every case we made a good weld. All the surface being exposed to the action of the arc and a comparatively low current being sufficient to cause fusion of the surface.

The type "B" or half level point offers no such favorable condition to welding as far as penetration is concerned, because at adjacent edges of the joint there is an appreciable thickness of metal, which must be actually penetrated before complete fusion of the joint can be attained, and that is why this type of joint requires a higher current than the full bevel joint.

The square joint requires more penetration that the half bevel and for that reason a still higher current is necessary.

Any attempt to analyze these tests on the basis of tensile strength will lead to nowhere at all, just as Mr. Miller suggests. The whole purpose was to find out what was the minimum current for full penetration in the different types of joints, and these tests served their purpose very well, and substantiated the ideas which we had on the subject before beginning the tests.

What Mr. Miller terms soundness is what we were dealing with in this instance, except that we were dealing with a particular kind of soundness.

In every case, the metal in the weld was excellent, the only variation was the penetration of the heat. Where it was insufficient, it simply meant that a part of the section was not fused, but the metal simply fused for a certain percentage of the distance down and ran in the rest of the way.

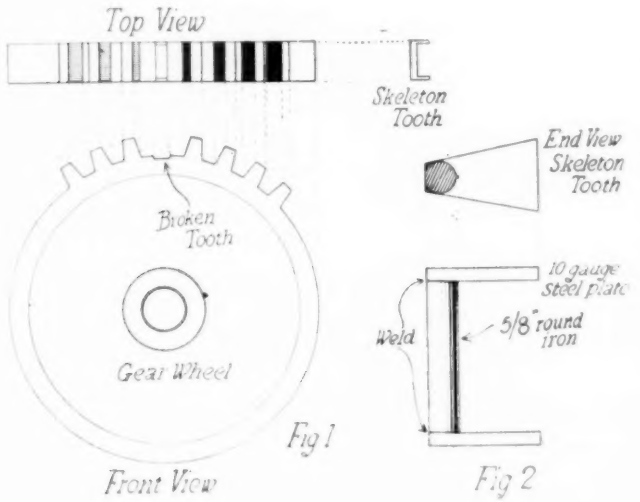
If we are to consider these tensile strengths as an indication of the quality of the metal itself, it would be necessary to know the actual section of the break, because if one-quarter of the surface of the break was not welded, then the actual tensile strength is much higher than the figures would indicate. On account of the fact that the figures indicate nothing of value, we did not attempt to use them in drawing our conclusions. Looking at it in this light, I believe Mr. Miller will have all his difficulties cleared up.

ARC WELDING MACHINE CO., INC.,
O. A. Kenyon, Electrical Engineer.

BUILDING UP TEETH

Editor:

I am sending you a sketch of a cast gear wheel, showing my method of putting broken cogs in large gear wheels. I cut down on each side of rim where tooth is broken out, say about 3/8 to 1/2" and about 1/8" deep. Then I make a skeleton tooth of say 10 gauge steel plate and weld between the two plates a 5/8" round steel bar, this skeleton tooth just fits snug into the recesses of rim cut out and must also be the right height. I then take a compass or divider and take the distance between two teeth in gear, or from center to center.



The skeleton tooth is then centered and I am ready to preheat rim and one or two spokes to prevent cracking wheel. I do not preheat very hot. The wheel is turned with broken tooth up. Skeleton tooth is spot welded in each side of rim, just enough to hold tooth in place while welding. The space underneath skeleton tooth is then filled in with cast iron. A bar is run through hub of wheel and supported in trussels, this being done at beginning of operation.

When tooth is filled in up as high as the bar of the skeleton tooth I swing wheel down so tooth is about horizontal and fill in what is necessary and run iron down good and smooth. I then swing wheel over to other side and weld other side of tooth. The size teeth I refer to are about as follows:

Tooth 1 1/8" wide at base, 2 1/4" long, 1 3/8" high. I have one hay press gear wheel in mind, into which I have welded eight teeth at different times in the last two years. None of the teeth I put in have broken. Just a few days ago I put in three teeth of the size above mentioned. The time and gas consumption was as follows: 5 1/2 hours labor, 38 cubic feet oxygen and acetylene in proportion, 2 quarts coal oil for preheating. The nice thing about it was, it took only 15 minutes or less to dress up the three teeth.

The above way of building in teeth does not require as much skill as building up a tooth without any support or guide to go by. It saves at least from 25% to 35% gas and also saves considerable labor dressing up tooth, besides it makes a stronger job.—J. N. Hanna.

THE WELDING.

Editor:

Noticing an article in the November number of The Welding Engineer regarding boiler flue welding would ask that you permit me to submit my method of doing same, not claiming it as the best, but merely as a friendly exchange of ideas and with a view of "drawing out" the other fellow's ideas on this particular line of welding. It is an undeniable fact that the old method of forge welding has passed into oblivion in nearly all shops that are abreast with the times. Boiler flue welding by the oxy-acetylene process is here to stay and it behooves the ones who are developing the new process to give it deep thought and use every effort to attain the highest standard of excellence as regards a maximum of strength with a minimum of time and gas used. To attain this an exchange of ideas and experience is very essential. The practice of taking out old flues, cleaning them and welding on "safe ends" is a very common one, so let us begin with the cleaning process. We put the flues in a revolving drum or "Rattler," running them from two to four hours, which removes all scale and also brings to view any defect that might be in the flue. After cutting off ends square the flues are ready for welding. In practice we have found that bevelling is not necessary, as a strong flame will penetrate the thickness of the metal very nicely when properly handled, thus eliminating the trouble and time lost in bevelling. I use roller bearings at each end of flue, which allows it to revolve freely, and place ends to be welded 1/8" apart, holding them in line with a clamp made of two pieces of suitable angle iron (16" long) with hand screw. After tacking three or four places clamp is removed. I use 1/8" Norway iron welding rod, never larger than this, as the rod should melt instantly when wanted. I also weld with a very strong flame, using a tip one or two sizes larger than for flat work of same thickness. A beginner on flues will find this very difficult to do at first but after "shooting" a few holes will soon learn to keep his torch moving. The strong flame enables the operator to preheat ahead and keep the weld going, thereby increasing the speed very much over the small tip method. He should watch the opening and keep it filling in or meeting in a molten state a short distance ahead of rod, which is following very rapidly. After welding and flue has cooled a helper removes any uneven places in one minute on an emery wheel. Each flue should be tested for leaks by plugging one end and filling with water, going over the welded seam with the hammer and using light blows only to bring out any defect that might exist.

The cost of welding is very easily obtained as a close record can and should be kept of gas consumption, filler used, time of cutting, welding and testing.

I may at some future time have something more to say

...ding the cost per flue from start to finish by the oxy-...lene process vs. forge welding

...uld like to hear from others on this subject.

C. Bolles.

EFFECT OF WELDING.

...Editor:

The writer is very much interested in tests reported in ...February issue, made at the works of the Westinghouse ...mpany at East Pittsburgh, Pa., tending to show the effect ...the electric arc on material adjacent to the weld.

The writer has taken an active interest in effects of this ...kind for a number of years, and was not aware that there ...was any belief current to the effect that material adjacent to the weld was injured by an arc of 60 volts, although it is generally admitted that it is possible to injure material that is deposited in the weld with an arc of 60-volts.

The effect of an arc upon the material adjacent to the weld is dependent upon all factors which determine the temperature of the metal at that point, and the length of time that the metal is maintained at a high temperature.

Arcs connected in series with a reactance, produce a tremendous temperature rise at the moment of breaking the circuit, and it is arcs of this kind which possess the power to injure metal by the mere striking and breaking of the arm. It would be interesting to continue the investigations in the series with which a reactor is connected, and also to include pieces in which the metal deposited in the weld is part of the test piece.

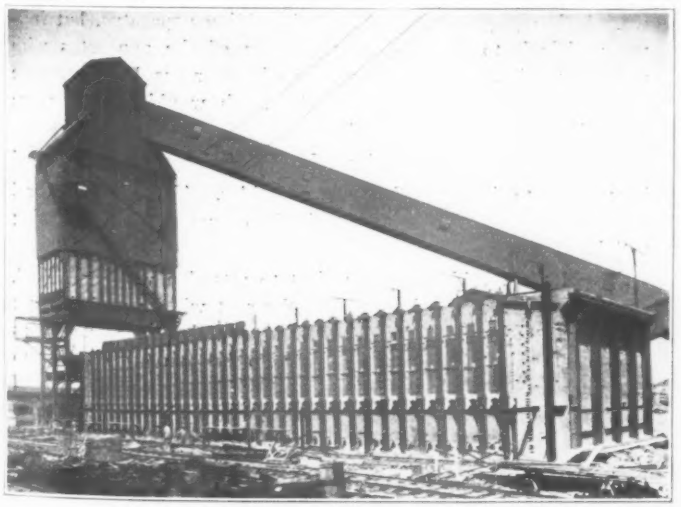
Undoubtedly, metal deposited on the solid plate in the form of a patch changes the structure of the steel as was evidenced by the decrease in elongation and reduction of area, as well as the increase in tensile strength. The writer has used this method for local heat treatment of welded joints, that is by depositing a layer of metal on top of the weld after it is completed, and then machining it off, with the result that the weld is stronger and the contr...ion strains practically eliminated.

ARC WELDING MACHINE CO., INC.,
O. A. Kenyon, Electrical Engineer.

CLEARING A BIG WRECK.

One of the most peculiar wrecks that has ever come to our notice is shown herewith.

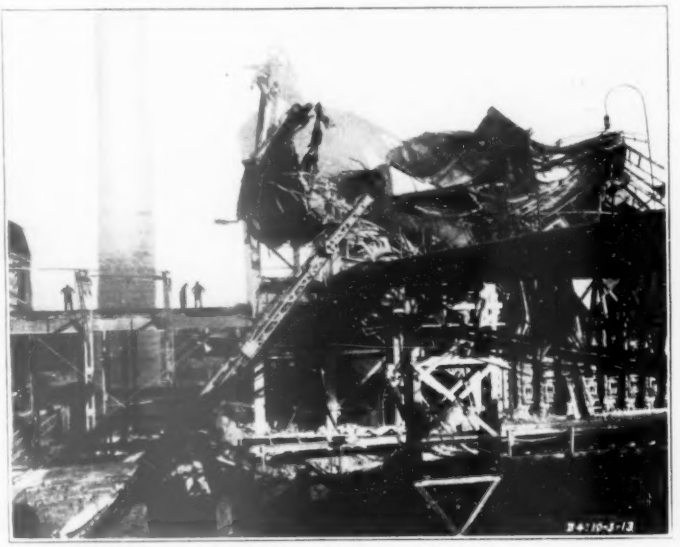
A giant coal tower standing at a height of 150 feet from



the ground, as shown in Fig. 1, which supplied the coke ovens of one of the largest gas producing plants in the United States, and which was considered by experts to be absolutely fireproof, as there was not one piece of wood in the entire structure, suddenly and without warning collapsed and fell a twisted, bended mass of a thousand shapes and angles, as shown herewith in Fig. 2.

Eight Oxy-Acetylene Cutting Blow Pipes were put into continuous service for seven days and nights in the process of removing this great mass of wreckage, and 130 tanks of oxygen and acetylene gas were consumed in its demolition.

Architects and mechanical engineers were at once called into consultation and found that a considerable deposit of



coal dust had lodged on the many flat beams, corners and projections, which took fire from the coke ovens below, and the immense weight of the huge pile of coal in the tower at the extreme top, and the steel supports becoming red hot caused the structure to buckle and collapse.

The moral and the mechanical lesson learned in this connection is that a new steel and concrete tower was constructed with all flat surfaces and corners eliminated by covering same with V-shaped angle plates of steel at angles sufficient to precipitate the deposits of coal dust to the ground below. This method has solved the problem and proved to be an architectural and mechanical success.

Charles H. Knight was the engineer in charge of the cutting.

WELDING PIPE.

Editor: Would appreciate data on welding 10-inch pipe to stand 125 lbs. pressure, cost per weld and the best method.

Answer: Prepare the edges of the pipe so as to form a 60 to 90 degrees angle. Separate the edges slightly. Hold the torch so that the envelope of the flame is directed towards the unwelded portion. Have the pipe turned while welding so that your weld is always progressing slightly uphill to prevent the possibility of the molten metal going on to cold metal.

Of course, you must recognize the ordinary rules of welding other than these, and secure fusion without burning. Use the best quality of low carbon welding rod and build up your weld to a thickness greater than the pipe.

Cost of such a weld, as you are probably aware, depends greatly upon yourself. Roughly speaking, you should use 10 to 12 cu. ft. of acetylene per linear foot of weld. The amount of oxygen you use will depend upon your torch, but it will be at least the same amount as the acetylene and probably more. You should average about one pound of welding rods per linear foot of weld.—Editor.

The Army (Ordnance Dept.) has opened another school of welding at Kenosha, Wis.

The Welding Engineer

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Teaching the Soldier.

IT will be of interest to the trade to learn that the recently established Davis-Bournonville School of Welding, at Jersey City, has been closed to the public, all of the facilities and resources of the school being placed at the disposal of the Government. The school, under the direction of Mr. Henry Cave, Director of the Department of Technical Research, is working to capacity in training soldiers.

When this war is won, as it most assuredly will be won, a great many corporations and a great many individuals, without military rank or title, will be entitled to the thanks of the nation.

Test Your Welds.

IN this issue of *The Welding Engineer* appears a report on the second installment of test pieces recently submitted for test purposes. We regret to say that the proportion of good welds to bad welds is distressing. It would appear that too many welders are relying upon outward appearance alone and not many of them are testing their own work.

It is not difficult to give your own handwork "the once over". Weld up a few pieces of tank steel, ½"x2" and try the simple bending test. The adverse results may surprise you. Some shops do this every week.

Army Welders.

ELSEWHERE in this issue we are publishing a report of the work being done at the Motor Section Instruction Schools, Ordnance Department, U. S. Army, Peoria, Ill. This is, we believe, a step in the right direction. The army needs welders and as there are very few welders who are eligible it is necessary to train them. These men, after the war, will find profitable employment in a trade which is now handicapped by a scarcity of operators.

Soaking the Publisher.

THE high state of efficiency in mechanical fields in the United States is no doubt due largely to the many high grade technical Journals available, at low prices. Information in America is cheap, and we can trace our progress from the very day we made it possible for citizens to secure cheap information. Some publishers have grown rich during the meantime, but for every one who has become wealthy there are thousands who are simply doing a fair business.

The new War Review Bill (which it is proposed to repeal) increases the second class postage rate on magazines and periodicals, in some cases 900 percent. A zone rate is to be applied, which means that the farther you are from Chicago the more you are going to pay for your copy of *The Welding Engineer*.

The section of the Revenue Bill establishing the new second-class mail rates and zone system should be repealed. No tax should be levied on the information that reaches the producers of the country through the trade and engineering press. We do not believe in the policy of bombarding members of Congress with frantic appeals to do or not to do this, that or the other; but this is a government of the people through their chosen representatives, and the people must bestir themselves to make their wishes known. Here is a blow aimed at an institution which means more to democracy than any other—an efficient periodical press circulating freely among the people of this nation. The zone system of postage rates sets up barriers between different sections of the country when the whole purpose of our lawmakers should be to cement the people into one solid invisible American democracy.

Welders and Ships.

WE have recently been asked to supply welders for ship yards. Here is a fine opportunity for you boys who have dependents and who are unable to "go over the top." The men behind are every bit as important as the lucky fellows at the front. The wages are good, and it's in the Nation's service. If you will accept a position as a welder or a cutter in a ship yard or navy yard, write Mackenzie.

Welding As An Occupation.

NO doubt the greatest factor in the growth and progress of the oxy-acetylene field has been the scarcity of good welders. It is not difficult to sell good welding apparatus, but it is more difficult to furnish the purchaser of the apparatus with a good welder. Could the maker of apparatus but guarantee good operators and the use of the torch would become more general.

The man possessing good mechanical judgment will not find it difficult to learn to become a welder. There are several roads he may take, all of which lead to a profitable, interesting and important vocation.

Should the would-be welder elect to attend a welding school or study under a practical welder, the cost will be probably not less than one hundred dollars. Of course, there are exceptions to this, for instance, a mechanic who has an opportunity to study under favorable conditions.

To the young man who possesses a notion he would like to serve his country, and at the same time acquire some valuable training, the army is offering an attractive opportunity. Recruits are trained in the art of welding—a very thorough training too—and after the war they will find their services very much in demand. We know of no better opportunity to learn the welding business.

The Dunwoody Industrial Institute, Minneapolis, is understood to be training welders for the Navy.

BOILER WELDING

Perhaps in No Other Field Is the Art of Welding Making Such Rapid Progress as in the Field of Boiler Repairs

Due to human fallibility, it is a fact that practically all new devices have to be developed toward perfection by service and that one seldom hears of a new thing being perfect at the start. This is very true of the oxy-acetylene welding and particularly so of boiler welding, which is subjected to stresses in service that cannot be approximated on any testing machine yet devised. The competitors of oxy-acetylene welding started with a theory that the high temperature to which the boiler plate is submitted will set up a great thermal disturbance in the vicinity of the weld. Another theory set against gas welding is incorporation of iron oxide in the weld.

These two theories are worthy of consideration and should be given the proper study by all oxy-acetylene welders and particularly those who are engaged in boiler or tank welding.

In studying the first theory that the thermal disturbance produced by the gas flame for a longer period on the metal, so as to raise it to the fusing temperature, one will find this theory accurate. That is, a considerable change in the growth of crystals will set in the vicinity of the weld. It will appear that the agent that causes this trouble is heat. However, we must not forget that it is heat who brought the birth of many new steels, and while heat can be employed to increase the life in metals, heat can also reduce and destroy the life and strength of metals. Therefore, if this agent is at our disposal, it remains for us to study how we shall employ it, so as to obtain the best results.

It is a well known fact that the structure of any autogenous weld that is composed of the added metal, is a cast metal. The structure of the boiler plate was originally also cast metal, but has been refined by the operations of heat and mechanical treatment, to a strong metal that we call boiler plate. The question is, can we employ the heating agent to refine the grain in the vicinity of a weld and to change the structure of the cast metal from the welding line as near to that of the boiler plate? It can be employed successfully, if the operator knows the physical and the chemical properties of mild steel.

Considering that an experienced operator has made a good weld on a fire box side sheet, and regardless how well the weld looks or how good a flame he had, the welding heat will change the structure in the vicinity of the weld and will also leave a cast metal weld in the welding line. It is necessary then to employ the heating flame of the blowpipe to refine the grain and to increase elongation in the welding line by a mechanical and heat treatment. The writer recommends the following method: Preparatory to welding, two rows of stay bolts should be set in on the opposite sheet, above and under the welding line, and tightened against the sheet that has to be welded. After the welding is completed, the operator should anneal to a bright red the welding line space about three inches long and two inches wide at a time and hammer lightly with hand hammer until the metal becomes cherry red, then the hammering must stop. The stay bolts on the back of the sheet will prevent the sheet from springing and hold the sheet at the heated area rigidly. The same operation should be followed until the whole line is annealed and hammered. If in addition to these heat and mechanical treatments, provision was made for the expansion and contraction while the metal was heated for the welding and annealing operations, then there is no danger of losing the mechanical properties of the boiler plate in the line of welding or in the vicinity of the weld.

The second theory that is laid against the oxy-acetylene welder, is the incorporation of iron oxide in the weld. In the early days of welding, the writer heard so much about this iron oxide that dissolves into the molten iron at the rate of

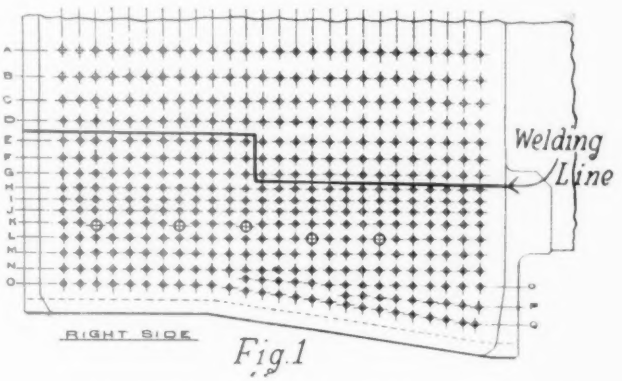


Fig.1

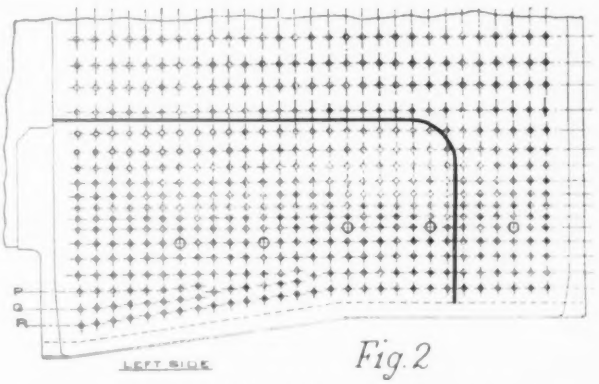


Fig.2

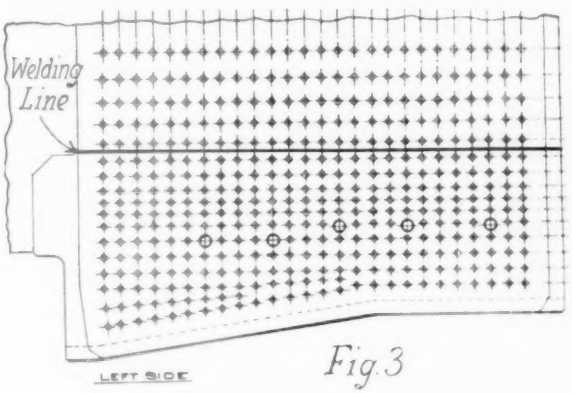


Fig.3

1.1 per cent, and in this reaction it destroys the carbon elements with the result of a decrease in the strength and elasticity of the weld. As we did not weld boilers in those days the writer did not pay attention to the oxidation scare. However, when he undertook to weld pressure vessels and the first failure occurred, he investigated the cause, and upon acid and micrographic tests, he found sufficient traces of oxide of iron

in the weld that convinced him of this evil and its results. The question was then how to prevent the forming of oxidation and how one shall know when oxidation is formed. At that time the writer had an idea that oxidation is an invisible enemy and an uncontrollable element in the welding trade.

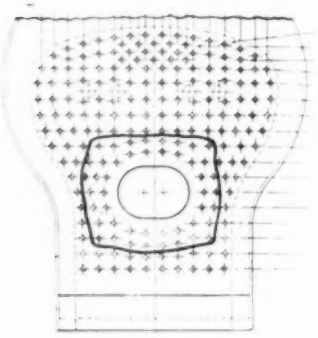


Fig. 4

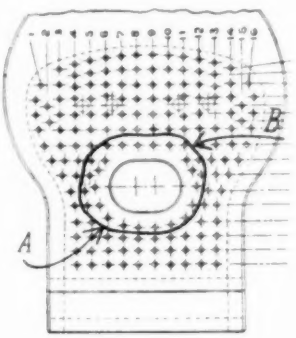
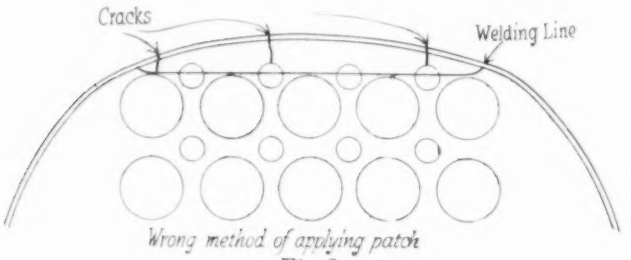


Fig. 5

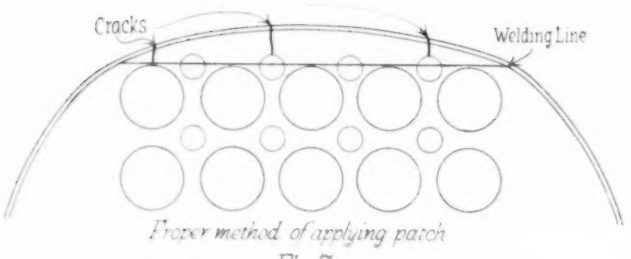
However, conscientious and ambitious welders with the help of our engineers have succeeded at the present time to eliminate this defect to an extent where oxidation cannot reduce the strength of a weld very much.

The first remedy to reduce oxidation was to reduce the pressure of oxygen as low as possible, just enough to produce a free flame (not too rigid) that will produce a continuous melting but without too much exaggeration. With such a flame one will notice the flow of the metal clean and regular, but with a too rigid flame which requires more oxygen one will notice a sort of white veins flowing in the molten metal. These white veins are streaks of oxide of iron and with a too powerful flame these veins of oxide will dissolve



Wrong method of applying patch

Fig 6



Proper method of applying patch

Fig 7

in the iron and create new ones with the progress of the weld. The molten metal is swept rather than laid in formidable clean layers, and an operator wastes a lot of skill to prevent adhesion.

Unfortunately there are a great many operators, instructors and demonstrators today who practice a hotter and more rigid flame than necessary for boiler welding, so they can show they can weld three feet per hour and beat the electric welder.

Oxide of iron cannot be altogether eliminated from any kind of a weld as long as we cannot protect them from the effects of the atmosphere, but it can be so decreased that its contents would do no harm to the weld.

The second remedy to exclude oxide of iron is to use a good and well known blowpipe that will deliver a normal flame and consume about an equal proportion of oxygen and acetylene. It is also necessary to employ reliable regulator valves with strong standard gauges so as to obtain a continuous steady flame.

The third remedy is to use a pure clean welding rod, such as Norway or Swedish iron, or if these cannot be obtained a pure soft charcoal or electroyltic iron may be used with good results.

There is one point that an acetylene operator must bear in mind and this is to make a strong weld. Economy should be considered as a secondary. While there must not be any useless waste in time or material, but we must consider that an oxy-acetylene weld cost more than an electric weld. But what is wanted now is efficiency. The welder that can make the stronger weld will get the business and preference regardless of the higher cost: therefore, I believe it is time that some of our operators investigate these two theories, and

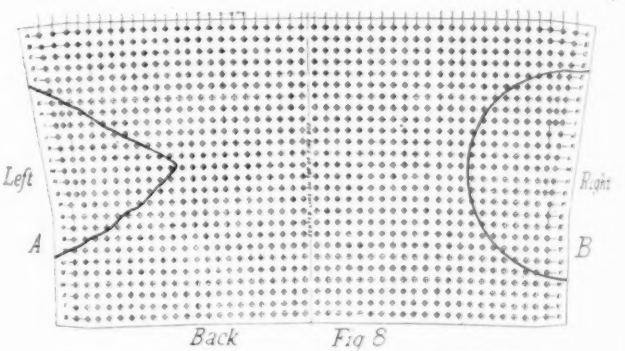


Fig 8

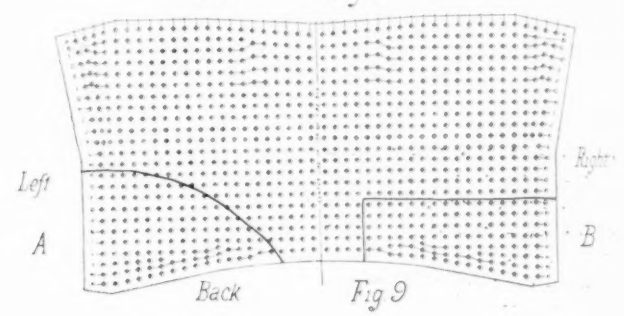


Fig 9

make further improvements for the benefit of the welding industry and particularly to the welding of pressure vessels.

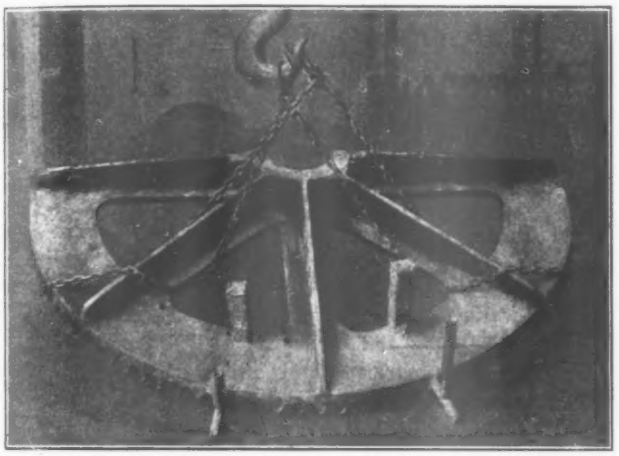
Expansion and Contraction.

The writer of this article was not exempt from failures but he can boast that from any experienced failure he tried to make a success of it by investigating and finding the cause of failure. However, when in some cases he could not find out the cause of failure he discontinued that particular operation until such time when he was enlightened as to its full course without depending on good luck.

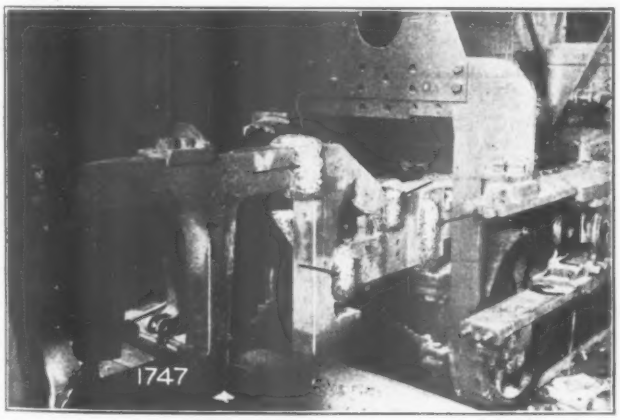
The every day problems of expansion and contraction on boiler welding are great and interesting and no operator should indulge in welding boilers unless he has some knowledge in boiler construction. That does not mean that he must know how to drive the sledge or be a regular boiler maker in order to be a boiler welder.

The effects of expansion and contraction are less feared by some boiler welders because the metal to be welded possesses the property of elongation. However, a boiler welder should not depend that the metal will give and that a little strain will not hurt the weld for two reasons. First reason is that almost in all cases an intelligent welder can find a

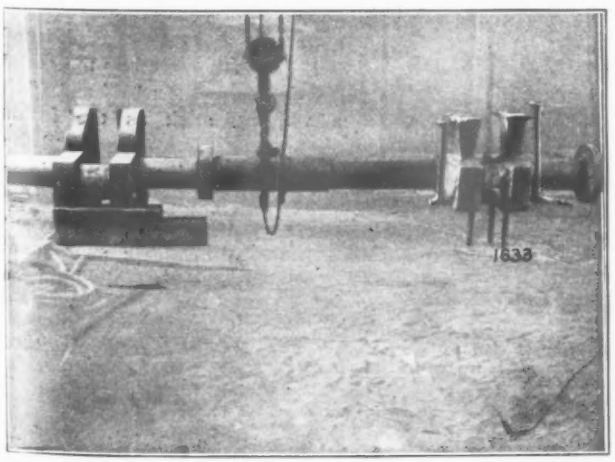
New neck cast on to large roll made with the aid of Thermit and having the pods cast in at the same time.



Large bevel gear on which two new teeth and crack have been repaired.



Four Thermit welds on locomotive frame on the Missouri Pacific Railroad, made without removing the frame from place.



New crank pin welded in by the Thermit Process.

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solution of how to take care of his expansion and contraction. Second reason is that no human being can measure or know how much of a strain is left in the metal. It may be very little or it may be to the breaking point. Therefore, one should not take any chances whatsoever in welding of pressure vessels, especially where he has means to protect his weld.

The best device known by the writer is the corrugation feature. In a fire box where a patch, side sheet, crown sheet or door sheet is set in for welding it is necessary that a corrugation be set in by the boiler maker close to the welding line, about one inch deep. This corrugation will not only give flexibility on the weld and its vicinity, but will enable an operator to reweld any defect in the future, using the same corrugation because the expansion and contraction of the welding line will be divided equally between each row of stay bolts into the corrugation. Small mud ring patches that extend not more than about 5 stay bolts high do not need any corrugation.

Welding by overlapping of the boiler plates should never be done by any autogenous welding process and it is surprising that some authors recommend it. The bad effect is the accumulating of oxide between the boiler plates; even when both edges are tight, air and moisture will get in between, oxidising the plates and weld.

Although the welder that has some knowledge of boiler construction will make a better boiler welder, yet the setting of patches or sheets for welding purposes should be done on an entirely different principle than the one of riveting.

Figures 1 and 2 are wrong methods of setting in side sheets for welding. Figure 3 is the correct method of setting in a side sheet. The edges should be arranged parallel, with but a 1/8-inch opening. One may commence welding at the center of seam and as the operator advances about six inches he will notice the edges will close a little. Then he should stop welding in that direction and begin on the opposite end, where he will experience the same thing after six or eight inches of welding. By that time the opposite end has cooled off and the edges have widened, and the operation should be continued in such alternate section until the whole seam is welded.

Figure 4 is a wrong arrangement for a fire door patch. Figure 5 is the right arrangement for a patch around the fire door and the writer has experienced the best success by driving in small iron wedges about six inches apart, then commenced welding at A from bottom up until he reached arrow B. The weld was left to cool and then continued from A to B.

Figure 6 shows the wrong method of applying a patch on top of flue sheet. Figure 7, which shows the same arrangement with a straight seam, is the proper method. Figure 8A is a less recommendable arrangement for a patch on account of its angular point. Figure 8B is the more favorable arrangement.

Figure 9B arrangement is not preferable, but Figure 9A is an excellent way of setting in a corner patch and it will require less welding.

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THERMIT WELDING AND OXY-ACETYLENE WELDING.†

Their Respective Fields and Applications.

By J. H. Deppeler.*

Editor's Note.—A paper such as The Welding Engineer, deriving its principal support from advocates of oxy-acetylene and electric welding systems, might be censored for publishing an article intended to minimize the importance of either of the two first named processes. We direct our readers' attention, however, to the fact that it is the function of The Welding Engineer to present a great variety of opinions, not necessarily the Editor's opinions, and in doing so we feel that we are adhering to the true traditions of honest trade journalism.—Mackenzie.

During the past few years the field of application for welding has broadened rapidly and at a rate that is astonishing. The answer is economy. Manufacturers in many lines have found it more economical to weld than to rivet parts together. New applications for existing welding equipment have been discovered, improvements in welding apparatus have opened up new fields of applications and the increased cost of raw materials and the greater length of time required for delivery, have compelled everyone using mechanical equipment to give serious consideration to the redemption of worn and broken parts that heretofore were discarded as junk. In fact, this growth in the application of welding has been so rapid that welding is now a universally established process possessing a commercial and mechanical efficiency of high order *when used in multitudinous fields for which the various methods are adapted.* We believe as one of the pioneers in the welding industry that the time has come for a plain and honest statement of facts for the enlightenment of the fraternity setting forth the features of the several methods of welding which limit their fields of application. The three up-to-date methods are Thermit, oxy-acetylene and electric welding, and we have, therefore, requested the chief engineer of the Goldschmidt Thermit Co., Mr. J. H. Deppeler, to prepare an article on the first two methods—i. e., Thermit and oxy-acetylene—as he is peculiarly fitted from past experience to write authoritatively on those subjects. Before coming with the Goldschmidt Thermit Co., Mr. Deppeler was in the oxy-acetylene welding business, and we do not know of anybody who is better fitted to compare that process with the Thermit process, and point out where one should be used and the other not.

To engineers thoroughly versed in these three welding processes, there is no confliction of fields, although naturally the fields do overlap slightly. This fact is evident, not only from the actual practice, but is plainly evident from the theory of the two methods of welding. Probably the arguments for and against can best be brought out by a short description of the vital points of each process and finally a comparison of the two.

Oxy-Acetylene Welding.

The parts to be welded are usually V'd out or scarfed and preheated, the torch melting and flowing together the metal at one spot after another at the bottom of the "V" and additional metal added from a welding stick as the fusion process continues. The weld is made "drop by drop," the first part solidifying before the next part has actually been welded, each part as it solidifies contracting and thus preventing the natural contraction of the next part and, consequently, introducing shrinkage strains in those subsequent parts. On this account, oxy-acetylene welding should be

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†*Reprinted from "Reactions," a quarterly journal published by the Goldschmidt Thermit Co.*

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limited to sections of relatively slight thickness, ranging from light sheet iron work and thin cast iron or cast steel sections to sections about 1 inch thick at the most. These comparatively thin sections can, by bending or warping, minimize and equalize the individual contraction strains of the various parts of the weld.

The case is very different where the section is over 1 inch thick, although naturally a matter of degree only. Here the parts first welded, not only solidify, but gradually cool from the white heat to at least a dull red with correspondingly large contraction before the last part of the weld is made, and the section being relatively thick cannot warp or bend so readily, thus increasing the strain and making it permanent, and furthermore, on account of the necessity for scarfing or V'ing, the width of the weld increases with increasing thickness of parts being welded, and consequently the amount of the shrinkage increases correspondingly.

The making of a proper oxy-acetylene weld requires very careful and constant attention on the operator's part and in spite of the dark glasses is very trying on his eyes. This makes the quality of the weld vary with the "quality" of the operator, and naturally the "quality" of any one operator varies greatly from time to time. In some of the first cases, operators have purposely bridged metal over narrow parts of welds, leaving large cavities beneath, and naturally completed the work more quickly and been able to get away from the intense heat and eye strain.

But even the most careful operator must have defects in his weld other than the natural strains mentioned above, and these are due principally to the flowing of molten metal from the filling rod on to unmelted surfaces of the part being welded. It is easy to realize how difficult it is to prevent this when one considers that the necessary procedure is to concentrate the flame with a circular motion on a certain relatively small spot until this spot is molten, and then to add one or more drops of metal from the filling rod to the center of this molten spot, being extremely careful not to add any to the outer edges or to an unmelted surface. This on small welds is comparatively simple, but as the welds increase in size, the operator naturally tries to increase the size of his molten puddle and the molten material gradually piles up like a small inverted saucer until the weight is sufficient to force it outward on the relatively cold metal, which it covers without welding to it. It is extremely difficult to prevent this even on horizontal surfaces, and the difficulty is very evident and practically impossible to overcome where the surfaces are vertical. On these surfaces, where the molten material is added, it quickly runs down and freezes on unmolten surfaces, and the best operator could not possibly obtain a proper weld nor homogenous metal in the weld. The section of such a weld usually shows these "cold-shuts" and entrapped oxide to the naked eye, but under the miscroscope it is very evident.

Regardless of how oxy-acetylene advocates talk, the above difficulties are insurmountable and they know it, and in practically every case where these advocates leave the oxy-acetylene field they will readily acknowledge the fact. Furthermore, many of the oxy-acetylene experts and these of the better variety, even though they may lose a sale of apparatus or repair, will acknowledge the limitations mentioned above and will not attempt work offered them over about 1 inch thick unless at the risk of the customer.

There are many other objections to oxy-acetylene welding, such as burning out of volatile materials in the added metal, reducing it to a very soft steel or iron, the burning of the steel itself due to overheating of some local parts of the weld, etc., but the above main points are so evident when given consideration that they are bound in time to limit oxy-acetylene welding to the field that it should properly cover.

As an instance of the softness of the added metal, can be mentioned the fact that very few reliable concerns will attempt to weld by means of oxy-acetylene, main journal breaks in small automobile crank shafts. Certainly these small shafts less than 1 inch in diameter lend themselves admirably otherwise to oxy-acetylene welding, but regardless of the filling rod used, the steel in the weld is so soft on account of the burning out of these volatile materials that the shaft in service is bound to deflect slightly, but surely, at each strain, and practically all of this deflection takes place in the weld itself, quickly crystallizing it and causing it to fail. We have known many oxy-acetylene concerns who have noted this fact and refused crank shaft repairs, but without being able to give a definite reason for it.

A Thermit weld is made after a space is provided between the fractured ends by flowing into this space and around the fractured ends molten steel produced (within about thirty seconds) at a temperature almost double that of ordinary molten steel, this melts the steel of the fractured ends back for considerable distance, locally recasting the part. The distance that the parts are melted back is usually about equal to the diameter of the parts; the principal feature of this method of welding is that the weld is all made at one time and that there is only, therefore, one shrinkage. Strains are frequently introduced due to improper allowance for contraction of the weld, but this is naturally the same with any form of welding, but the local internal strains mentioned in connection with oxy-acetylene welds cannot be present, and it takes very little skill on the operator's part to properly allow for the contraction itself.

Thermit welding does not, therefore, depend upon the skill of the operator to any great extent, the points to be watched being the allowance for contraction and the cleanliness of the weld, which includes the absence of dirt on the pieces to be welded and the absence of sand or foreign matter from the mold itself. There are definite rules covering the amount of Thermit to be used, the width and thickness of the Thermit collar and the space provided between the sections which dimensions are determined from the diameter or the section of the part itself, so that nothing is left to the judgment of the operator except the contraction mentioned above.

Thermit steel can be produced of any composition desired, so as to produce welds of any physical properties within reason. In many cases, the weld is stronger and tougher than the parts welded, but naturally where high-grade steels are considered the weld cannot be quite as strong if all excess metal be removed.

The same internal shrinkage strains, always present in oxy-acteylene welds, can be produced by gross carelessness in the making of Thermit welds. For instance, imagine a section of a steel bar cracked half way through. The proper Thermit practice would be to cut or break the bar all the way through at this point, but if the welder should attempt to cut the fracture part way only and repair this by means of a Thermit weld, the result due to contraction would naturally be to shorten the side of the bar welded, making it take the form of a very flat "V" with the weld at its center. Every welder would naturally expect this result, especially if the unwelded and unfractured part of the bar were about 1 inch thick or less; but imagine further that this unfractured part were 6 inches thick or more, would it not be doubtful whether the contraction of this weld could bend so heavy a section. Yet this is the same effect that is always obtained in a greater or less degree in every oxy-acetylene weld, the last part of the weld attempting to bend the whole section, and while the welded part is relatively

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thin, it accomplishes this purpose, but as the weld increases in thickness it is unable to do so and an enormous shrinkage strain results.

There are many cases in Thermit welding where similar strains might be introduced not quite so evident as the above; for instance, imagine a cast steel slab 12 inches wide by 12 inches thick and a 4-inch diameter hole bored through as a bearing for a shaft. Usually, in such cases, on account of the strain on the shaft itself, the cast steel section fractures through the thinner parts, that is, from the hole to the outer edge, which in the case mentioned above would give a section at the fracture 12 by 4 inches. A good Thermit welder would probably insist upon the cutting or fracturing of the 12 by 4-inch section at the opposite side of the shaft hole, so as to pour both the welds at once and to prevent the formation of a strain. This strain could not be eliminated in any other way, because even though he took the precaution to preheat the unfractured side to a white heat, it would then be in the same condition as the fractured side, and the contraction of the molten steel in the Thermit weld would not be taken care of and would have to bend the unfractured side. Such a procedure would not be possible by oxy-acetylene welding, because even though two operators would attempt the work, one making each weld, the total expansion of each weld due to the heat would not be constant or uniform, and there would first be a tension strain in one part and compression in the other, and then this would probably reverse numerous times during welding and this working of the acetylene weld during making would introduce the strains and defects which could not be possibly overcome.

There are many other points that could be brought up and discussed, but the above, we feel, are the most important and the defects usually acknowledge by even the oxy-acetylene experts themselves, and their answer usually is to refer to a few instances where the welds held and thus accomplished their object, but certainly since one type of weld is bound to have the defects and the other type not, the number of the failures in the first type must necessarily be greater than in the second type.

The Thermit process, therefore, is primarily adapted to the welding of heavy sections, and the limit in the size of the weld is only governed by the safe limitations of mold construction and crucibles to hold the Thermit charge. It is not adapted to welding very small sections or long seams in thin sections, which work can be admirably accomplished by the oxy-acetylene or electric welding processes. It should, however, always be used for welding shafts no matter how small when the break is in a journal.

THE DEVIL HAS RESIGNED

(Continued from Page 21)

"The inherited disease of the Hohenzollerns killed your father, just as it will kill you, and you became the ruler of Germany and a tool of mine sooner than I expected.

"To assist you and farther hasten my work I sent you three evil spirits, Nietzsche, Treitschke and later Bernhardi, whose teachings inflamed the youths of Germany, who in good time would be willing and loyal subjects and eager to spill their blood and pull your chestnuts, yours and mine; the spell has been perfect—you cast your ambitious eyes toward the Mediterranean, Egypt, India and the Dardanelles and you began your great railway to Bagdad, but the ambitious archduke and his more ambitious wife stood in your way. It was then that I sowed the seed in your heart that blossomed into the assassination of the Duke and his wife, and all hell smiled when it saw how cleverly you saddled the crime on Serbia. I saw you set sails for the fjords of Norway and I knew you would prove an alibi. How cleverly done, so much like your noble grandfather, who also secured an assassin to remove old King Frederick of Denmark, and later robbed that country of two provinces that gave Germany an opportunity to become a naval power. Murder is dirty work, but it takes a Hohenzollern to make away and get by.

"Your opportunity was at hand; you set the world on fire and bells of hell were ringing; your rape on Belgium caused much joy, it was the beginning, the foundation of a perfect hell on earth, the destruction of noble cathedrals and other infinite works of art were hailed with joy in the infernal regions. You made war on friends and foe alike and the murder of civilians showed my teachings had borne fruit. Your treachery toward neutral nations hastened a universal upheaval, the thing I most desired. Your under-sea warfare is a master stroke, from the smallest mackerel pot to the great Lusitania you show no favorites: as a war Lord you stand supreme, for you have no mercy; you have no consideration for the baby clinging to its mother's breasts as they go down into the deep together, only to be torn apart and leisurely devoured by sharks down among the corals.

"I have strolled over the battlefields of Belgium and France. I have seen your hand of destruction everywhere; it's all your work, super-fiend that I made you. I have seen the fields of Poland; now a wilderness fit for prowling beasts only; no merry children in Poland now; they all succumbed to frost and starvation—I drifted down into Galicia where formerly Jews and Gentiles lived happily together; I found but ruins and ashes; I felt a curious pride in my pupil, for it was all above my expectation. I was in Belgium when you drove the peaceful population before you like cattle into slavery; you separated man and wife and forced them to hard labor in trenches. I have seen the most fiendish rape committed on young women and those who were forced into maternity were cursing the father of their offspring and I began to doubt if my own inferno was really up to date.

"You have taken millions of dollars from innocent victims and called it indemnity; you have lived fat on the land you usurped and sent the real owners away to starvation. You have strayed away from all legalized war methods and introduced a code of your own. You have killed and robbed the people of friendly nations and destroyed their property. You are a liar, a hypocrite and a bluffer of the highest magnitude. You are a part of mine and yet you pose as a personal friend of God. Ah, William, you are a wonder. You wantonly destroy all things in your path and leave nothing for coming generations.

"I was amazed when I saw you form a partnership with the impossible Turk, the chronic killer of Christians, and you a devout worshipper in the Lutheran church. I confess, Wilhelm, you are a puzzle at times. A Mohammedan army, commanded by German officers, assisting one another in massacreing Christians is a new line of warfare. When a Prussian officer can witness a nude woman being disemboweled by a swarthy Turk, committing a double murder with one cut of his saber, and calmly stand by and see a house full of innocent Armenians locked up, the house saturated with oil and fired, then my teachings did not stop with you, but have been extended to the whole German nation. I confess my Satanic soul grew sick and there and then I knew the pupil had become the master. I am a back number, and my dear Wilhelm, I abdicate in your favor. The great key of hell will be turned over to you. The navel that has struck the doom of damned souls since time began is yours. I am satisfied with what I have done; that my abdication in your favor is for the very best interests of hell—in the future I am at your majesty's service. Affectionately and sincerely,

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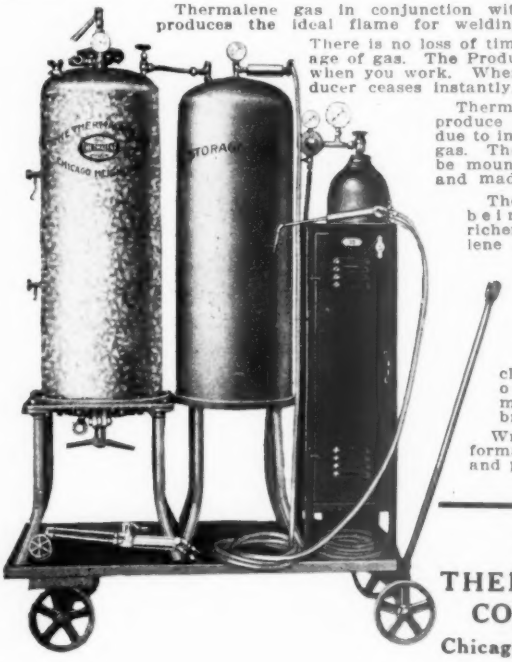

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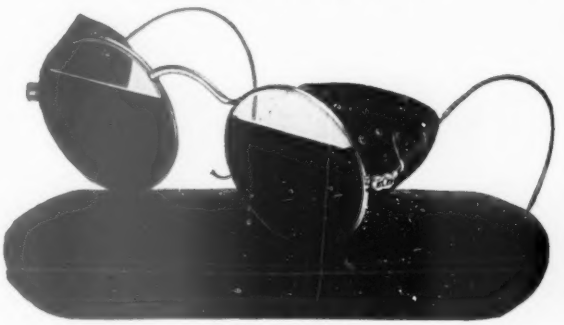

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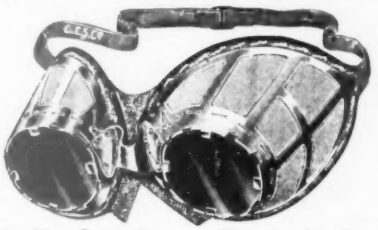

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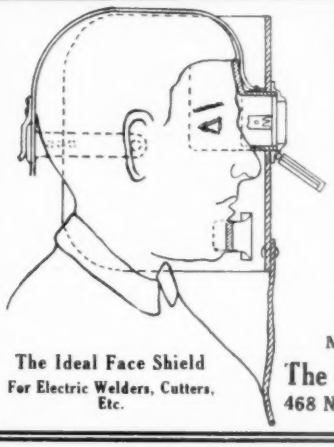

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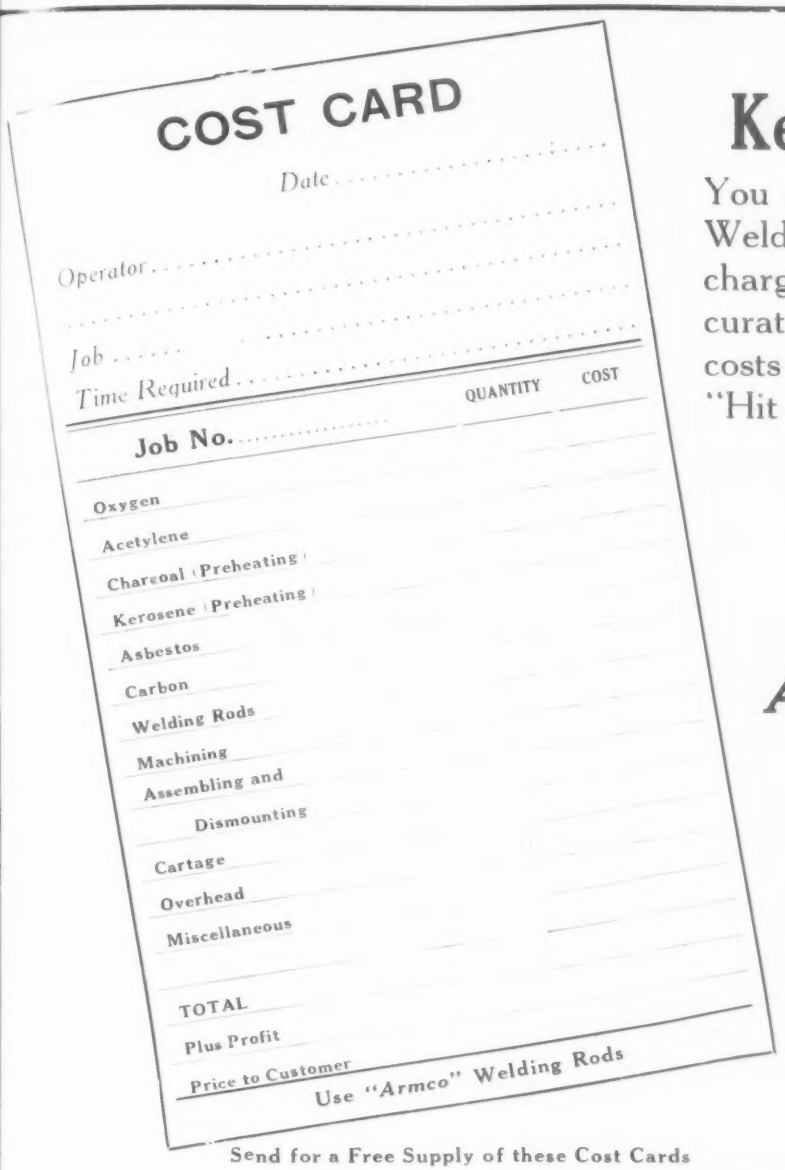

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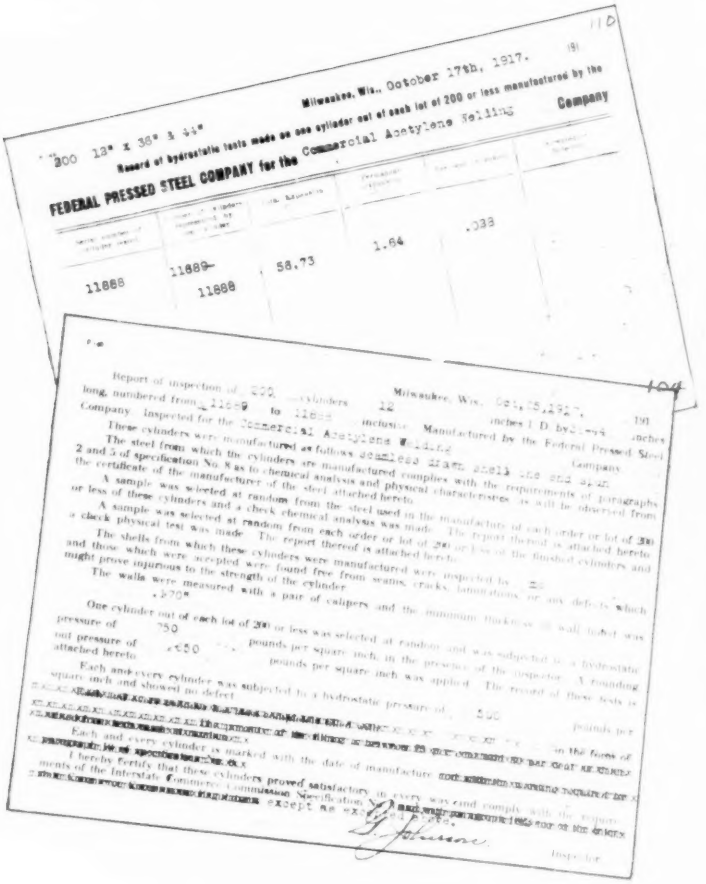

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